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MUSCLE SHOALS

HEARINGS

U.S. Congress. Senate.

BEFORE THE

COMMITTEE ON AGRICULTURE AND FORESTRY

UNITED STATES SENATE

SIXTY-SEVENTH CONGRESS

SECOND SESSION

ON

S. 3420

TO PROVIDE FOR THE MANUFACTURE OF EXPLOSIVES FOR THE USE OF THE ARMY AND NAVY, TO PROVIDE FOR THE MANUFACTURE OF FERTILIZER FOR AGRICULTURAL PURPOSES, TO INCORPORATE THE FEDERAL CHEMICAL CORPORATION, AND FOR OTHER PURPOSES; AND

ON

THE HENRY FORD MUSCLE SHOALS OFFER; OFFER MADE BY THE ALABAMA POWER CO., PROPOSING TO COMPLETE WILSON DAM; OFFER OF FREDERICK E. ENGSTRUM FOR MUSCLE SHOALS, AND OFFER OF CHARLES L. PARSONS FOR PROPERTIES AT MUSCLE SHOALS, ALA.

FEBRUARY 16, APRIL 10, 12, AND 13, 1922

PART 1

Printed for the use of the Committee on Agriculture and Forestry

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MUSCLE SHOALS.

THURSDAY, FEBRUARY 16, 1922.

UNITED STATES SENATE,
COMMITTEE ON AGRICULTURE AND FORESTRY,
Washington, D. C.

The committee met, pursuant to call, at 10.30 o'clock a. m. in room 224, Senate Office Building, Senator George W. Norris presiding

Present: Senators Norris (chairman), Page, McNary, Capper, Keyes, Harreld, Ladd, Smith, Ransdell, Kendrick, Harrison, and Heflin.

The CHAIRMAN. The committee is in session this morning for the purpose of hearing Governor Taylor, of Tennessee, and his associates on the Muscle Shoals proposition.

I will ask the reporter to copy the bill that we are considering into the record at this point.

(The bill referred to is here printed in full, as follows:)

[S. 3420, Sixty-seventh Congress, second session.]

A BILL To provide for the manufacture of explosives for the use of the Army and Navy, to provide for the manufacture of fertilizer for agricultural purposes, to incorporate the Federal Chemical Corporation, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Secretary of War is hereby authorized and directed to complete the construction of Dams Numbered Two and Three in the Tennessee River, at Muscle Shoals, Alabama, in accordance with the terms of such project as adopted by the letter of the President dated February 23, 1918, under authority of section 124 of an act entitled "An act for making further and more effectual provisions for the national defense, and for other purposes," approved June 3, 1916; and in order to provide for a larger amount of primary power to be developed at said dams, the Secretary of War is authorized and directed to cause surveys to be made above said dams on the Tennessee River and its tributaries for the purpose of locating storage reservoirs, and if a suitable site or sites can be found upon such investigation, where practical storage reservoirs can be obtained at reasonable cost, the Secretary is directed to take the necessary steps to secure such sites and to build the necessary dams for the impounding of water therein. If the Secretary of War, under authority of this act, constructs one or more dams for the purpose of impounding the waters of said river he shall give due consideration in the construction of such dams to the possibilities of the development of hydroelectric power and to the necessities of navigation.

SEC. 2. That in the construction of said Dam Numbered Three, or in the construction of other dams or other works provided for in this act, the Secretary of War is hereby authorized to use and to remove any of the temporary buildings now owned by the Government of the United States and erected anywhere in the vicinity of Muscle Shoals or nitrate plants numbered one or two, providing the removal of such buildings will not interfere with the operations of the Federal Chemical Corporation as hereinafter set forth.

SEC. 3. That if the Secretary of War should find it advisable and practical to construct storage reservoirs on the Tennessee River or any of its tributaries as hereinbefore provided, and that by virtue thereof the flow of the Tennessee River is equalized and a larger amount of primary power thereby developed, he shall require of any private person, partnership, or corporation maintaining a dam on said river for the development of power, to contribute his or its proportionate share for the construction of said reservoirs, and he is hereby authorized to take the necessary action or actions in court for the purpose of

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compelling contribution to such development by any person, partnership, or corporation receiving the benefits therefrom; and if the right to dam said river for the purpose of developing hydroelectric power is hereafter given by virtue of any law of the United States, to any person, partnership, or corporation, one of the requirements of said grant shall be that the person, partnership, or corporation given the privilege to build any such dam, shall pay his or its proportionate share of the expenses of the construction of any such reservoir or reservoirs, either then constructed or thereafter constructed by virtue of this act.

SEC. 4. That there is hereby incorporated and created a corporation by the name, style, and title of "The Federal Chemical Corporation" (hereafter referred to as the corporation). Said corporation shall have perpetual succession and shall have power—

(1) To adopt, use, and alter a corporate seal;

(2) To sue and be sued and to complain and to defend in any court of law and equity within the United States;

(3) To make and enforce such contracts as may be necessary to carry out the provisions of this act;

(4) To appoint and fix the compensation of such employees, attorneys, and agents as are necessary for the transaction of the business of the corporation, to define their duties, require bonds of them, and fix the penalties thereof; but in no case shall any such employee receive a salary in excess of $12,000 per annum;

(5) To prescribe, amend, and repeal by-laws not inconsistent with this act for the conduct of its business; and

(6) To exercise all the rights, powers, and privileges conferred upon it by this act and such additional powers as may be necessary to carry out the provisions of this act.

SEC. 5. That the business of said corporation shall be transacted by a board of directors (hereinafter called the board), consisting of three persons, to be appointed by the President of the United States, and by and with the advice and consent of the Senate. Members of said board shall hold their offices during good behavior and shall receive a salary of $7,500 per year, payable monthly: *Provided*, That any member of said board may be removed from office at any time by a concurrent resolution of the House of Representatives and the Senate. No member of said board shall during his continuance in office be engaged in any other business, but shall give his entire time to the business of said corporation. Said board shall select one of its members as president. It shall select a treasurer and as many assistant treasurers as it deems proper, and such treasurer and assistant treasurers may be corporations or banking institutions and shall give such security for the safe-keeping of the moneys of said corporation as the board may require. In the appointment of officials and the selection of employees for said corporation and in the promotion of any such employees or officials no political test or qualifications shall be permitted or given consideration, but all such appointments and promotions shall be given and made on the basis of merit and efficiency. The board shall give publicity to any request, coming from any source, asking for any favor in behalf of any person or the promotion of any employee. Any member of said board who permits the use of political or partisan influence in the selection of any employee, or in the promotion of any such employee of said corporation, or who gives any consideration to political considerations in the official action of said board, or who, knowing that such political influence has been or is attempted, does not give publicity to the same, shall be deemed guilty of a misdemeanor and upon conviction thereof shall be fined in a sum not exceeding $1,000 or be imprisoned not to exceed six months, or both such fine and imprisonment, and the conviction of any member of said board of the offense herein defined shall have the effect of removing such member from office.

SEC. 6. That upon the completion of the organization of said corporation, the President and the Secretary of War shall turn over to said corporation United States nitrate plants numbered one and two, erected at Muscle Shoals, Alabama, together with all real estate used in connection therewith; all machinery, tools, equipment, accessories, and materials thereunto belonging; all laboratories and plants used as auxiliaries thereto, including the Fixed Nitro- esearch Laboratory at Washington, the Waco Quarry in Franklin Alabama, the Warrior steam plant at Gorgas, Alabama, together with

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the transmission line from Gorgas to Muscle Shoals; the railroad, together with the engines, cars, tools, materials, machine shops, and all accessories used in the operation of said railroad at or near Muscle Shoals, Alabama; and all other power units and transmission lines of the United States used as auxiliaries of the United States nitrate plants numbered one and two: *Provided, however*, That the transfer of any of the property above described to said corporation shall be subject to such use of said property by the Secretary of War as he may elect, in the construction and development of the dams hereinbefore provided for.

As soon as any of the dams herein provided to be constructed by the Secretary of War have been completed the President and the Secretary of War shall turn the same over to said corporation, and thereafter said property shall be in the control and under the management of said corporation. Said corporation shall also have the power and authority to acquire, establish, maintain, and operate such other laboratories and experimental plants as may be deemed necessary or advisable by said corporation to carry out the provisions of this act. It shall have power to establish agencies anywhere in the United States for the sale of its products, and in order to prevent a monopoly of the fertilizer business or the undue and unreasonable advance in the price of fertilizer, it shall have power to manufacture a completed fertilizer ready for use, and if necessary, to sell the same direct to farmers or to organizations of farmers; and in the sale of chemical parts of fertilizer to manufacturers thereof, it shall have power to prescribe the price at which such manufacturer so purchasing any of the corporation's products shall sell the fertilizer to the farmer. It is hereby declared that one of the objects of this act is to regulate the sale of fertilizer to persons engaged in agriculture with a view to preventing the control of the price of such fertilizer by a monopoly or the sale thereof at unreasonable prices.

Said corporation is authorized to negotiate with the Alabama Power Company for the purpose of settling the difficulties existing between the Government of the United States and the said power company by virtue of the joint ownership of the power plant at Gorgas, Alabama; and it is authorized to sell the interest of the Government of the United States in said plant to the said Alabama Power Company, and to use the money received therefor in the operation of its business as hereinbefore described: *Provided, however*, That no such sale and no such agreement shall be valid or binding until approved by the President of the United States.

SEC. 7. That said corporation shall proceed to remodel nitrate plant Numbered One, at Muscle Shoals, Alabama, so that the same may be used for the manufacture of explosives and for the manufacture of fertilizer; and proceed to erect the necessary buildings and install the necessary machinery so that nitrate plant Numbered Two may be used for the manufacture of fertilizer. It shall be the duty of said board, through the operation of its laboratories and experimental plants, to devise and install improvements in nitrate plants Numbered One and Two as such experiments and developments may, in the judgment of the said board, be deemed advisable.

SEC. 8. That in case all of the power developed at Dams Numbered Two and Three, and at any other dam or dams constructed by the Secretary of War under the provisions of this act and turned over to the corporation, can not be used to practical advantage and is not necessary for the manufacture of fertilizer or for explosives, as herein provided, the board may in its discretion sell any such surplus power so developed to any State, municipality, district, corporation, partnership, or person upon such terms and under such conditions as the board may deem just; and if there is a demand for the purchase of such surplus power from both private and public interests, the board shall give precedence in the sale thereof to States, counties, and municipalities, and if the sale of any such surplus power is made to private individuals, partnerships, or corporations the board may as one of the conditions of such sale provide in the contract of such sale for the regulation of the price at which any such individual, partnership, or corporation shall charge the consumer in a resale of such power.

SEC. 9. That from time to time the Secretary of War shall notify said board of the approximate amount of explosives that in his judgment will be needed by the Army and Navy, and it shall be the duty of the board to supply the Army and Navy with the amount of explosives so required; and in time of war, or at any other time when in the opinion of the President of the United States, war is imminent, the President may take full possession of all of the property herein described and use the same for the manufacture of explosives to be used by the Army and Navy; or, in such case, the President may, if he

so elects, direct the board to cease, either in part or wholly, the manufacture of fertilizer and to utilize said property to such extent as he may direct, in the operation of explosives. Until such was is ended, or in the opinion of the President the danger thereof has passed, the said board shall operate said property in accordance with the direction and under the instruction of the President of the United States.

SEC. 10. That the board shall make a full, complete, and detailed report of its operation as soon after the close of each calendar year as possible to the Congress of the United States. In addition to the report so made the Secretary of War shall, at least once each year, make a complete audit of all the accounts and all the financial operations of said corporation, and shall include in his annual report to Congress a detailed statement thereof.

The principal place of business of said corporation shall be established by the board at or near Muscle Shoals, Alabama.

STATEMENT OF HON. ALF A. TAYLOR, GOVERNOR OF THE STATE OF TENNESSEE.

Governor TAYLOR. Mr. Chairman and gentlemen of the committee, I promise you in advance that I shall be very brief in what I may have to say. We are very much interested in the Henry Ford proposal. We believe that his proposition is a very good one. We believe that he is the best proposer. We think that he is an honest man. My contact with him has led me to believe that he is an honest, clean man. If I needed an indorsement to increase my confidence, the indorsement of one man I know of would be sufficient for me, and that man is Thomas A. Edison, whom I have the honor of knowing. He said in my presence that it was impossible to conceive the immensity of the power that could be produced by that plant when completed, and that the benefits to be derived to the country at large were also inconceivable, and that Henry Ford was the man to take hold and operate it when it was completed, because he was an honest man, and a man of splendid judgment, and a man who had succeeded, and a man who had the money.

Of course, the project was commenced as, perhaps, a war measure, looking to the manufacture of munitions of war, but it can be easily converted into the products of power to manufacture the implements of peace.

Now, it is an obstruction to navigation as it is. People used to use the Tennessee River to carry their grain and their iron and things that they had to sell down the river to Paducah at least eight months in the year. There was a packet company at Chattanooga that used it for eight months in the year. I remember 60 years ago that my father used to take his boats down the river, even out of the Watauga.

The CHAIRMAN. The reason that they did not use it for 12 months was on account of the low water?

Governor TAYLOR. Yes, sir.

The CHAIRMAN. There is no ice to interfere with commerce on that river?

Governor TAYLOR. No, sir.

It is an obstruction to navigation. If it is completed, it makes the river navigable the year around, because that is provided for; and then, look what it means in the way of cheap power. It is in the heart of a great agricultural region, and a great mineral region, and also a great timber region. About the only virgin forest left of hardwood timber is in that region, and we have iron, coal, copper, zinc, lead, manganese—most every mineral we possess—and it has not been developed so far simply because of the lack of machinery and cheap power to operate it. If the project is completed and the power developed, it means new enterprises, it means a new field for the employment of labor, and will do more to solve the unemployment condition in this country than anything that could be done by Congress. It means new wealth, the creation of new wealth, the enlargement of the bases of taxation—national, State, and county.

It means new life, gentlemen, new hope, and it is needed at this time. There is a dearth in business. There is depression among the people, and they are longing for something to be starting.

The completion of this project will give life and give hope, will act as an impetus to every class of business in every line.

Now, I heard a gentleman say, "We do not live in that region; it is in the South." Now, of course, no argument is needed in this committee of Senators to attempt to show them that sectional prejudice ought not to cut any figure in this matter. We did not offer any objection when the Government was ex-

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pending $116,000 to develop the great West. We did not offer any objection when they were spending all this money in those irrigation projects of the West, the building of the Roosevelt Dam in Arizona, and all those projects looking to the development of the western sections of our country. We rejoiced. We did not offer any argument against the donation by the Government of the United States of about 117,000,000 acres of the public domain, in which we were interested equally with all the rest of the United States, in encouraging the construction of railroads, to solve the question of transportation in the interest of the developement of the great West. We rejoiced. We said "Amen. What is good for the West is good for the South." What is good for one section of this Union is good for every section of this Union.

There is very little projudice left. We have been together and have shown what we could do when we all get together. We were divided once. I remember it. I lived through it, a mere boy, but I remember it as if it were yesterday, when we were divided and hostile. But there have been two occasions when we get together in this country since that division. We were united in the Spanish-American War, when the first blood spilled in that war was the blood of a son of the South. We were a unit in the World War, when the boys were called upon from every section to rally to the flag, and they rallied and constituted an army that turned the tide of battle in the World War, and I do not make the statement in disparagement of any other military organization in that great army, but it so happened on account of location; it so happened that the division, the immortal Thirtieth Division, composed of South Carolinians, Georgians, Tennesseeans, and Alabamians, were the first to break the Hindenberg line.

Now, gentlemen, pass this measure, and every vestige of any sectional prejudice that may linger will be wiped away forever.

It is a great proposition and, as I said before, Henry Ford is the man to operate it when it is finished. He is an honest man, as I said before, and he does not wish to take hold of it with the view of making money. He said so. I heard him say so time and time again, and I believe him. He wants to do something for his country. He wants to increase production of the farms throughout the United States. It is natural that he, like other great financiers, when they get to be of his age, want to build himself a monument. He is following in the footsteps of other great American financiers, and it is highly commendable for men to use their great wealth for the upbuilding of their country, for the uplift of mankind.

He said he had all the money he wanted. He told me he had all the money he wanted, and that his family had all the money they wanted. If they lived to be as old as Methuselah, they could not spend it. He wanted to make cheap fertilizers for the country and use that vast power there for the upbuilding of the country and the upbuilding of humanity.

I express the sentiments of every man and woman in Tennessee, without any exception, without regard to political affiliations, without regard to anything; I express the sentiment of every human being in my State, when I say that they are looking and longing for Congress to pass this great measure.

I thank you, gentlemen, for your very kind and courteous hearing.

The CHAIRMAN. We are very much obliged to you, Governor.

Who is your next witness?

Governor TAYLOR. As to its effect on agriculture, gentlemen, if you so desire, I have brought with me the commissioner of agriculture of Tennessee, and I would like for you to see what kind of looking men our farmers in Tennessee are now.

The CHAIRMAN. Is your commissioner a farmer?

Governor TAYLOR. My commissioner is a farmer, and a No. 1 farmer, and he fought as a captain during the Spanish American War and made an enviable record.

Capt. Thomas F. Peck.

The CHAIRMAN. Captain Peck, we will be very glad to hear you.

STATEMENT OF MR. THOMAS F. PECK, COMMISSIONER OF AGRICULTURE OF THE STATE OF TENNESSEE.

Mr. PECK. Mr. Chairman, I will just make a short statement of my reasons for believing that the Government should accept the offer made by Henry Ford for Muscle Shoals.

The production of crops depletes the soil, no matter where located or how fertile. If the plant food taken from the soil by each crop each year is not re-

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placed in some form, decreased production will follow. Nitrogen, the most important element of plant food, is the easiest exhausted, and has been found the most difficult and expensive to replace. Maintaining the fertility of the soil is of vital importance to every agricultural section of the United States, and every means of doing this and every movement in that direction that is feasible should be encouraged. Different sections of our country produce different products, required by all the people for food and for clothing. All sections of the country are dependent on each particular section for the product it supplies. This is particularly true of the section in which Muscle Shoals is located, for it is in the heart of the greatest cotton producting section of the world—the South—which supplies the mills of New England and Old England, of France, Belgium, Italy, and mills in all sections of the world. Any project which will make it possible for the farmer of the South to obtain cheaper fertilizer, so necessary in the production of his crop, will enable him to raise more cotton to the acre, and will result in good to the whole country—not alone to the South. The benefits of increased production of crops are not confined to the producing farmer, but are also reaped by the consumer, and any movement that will result in increased production should be encouraged. I believe that the acceptance of the offer of Mr. Ford will result in greatly increased crop production in the South, and will be of great benefit to the whole country.

Developing the water power possibilities of Muscle Shoals, as begun by the Government, and which is proposed to be completed by Mr. Ford, will make available an immense amount of cheap power which can be utilized in the manufacture of the raw material found in that section in such great variety and quantity. The argument has been advanced that this would be a sectional benefit. On the contrary, experience has shown that the citizenship of sections where such resources have been developed have received a mess of pottage for their birthright in the pittances paid such local labor as was employed. In most instances the profits have been enjoyed by the shrewd investors of other sections of the country, who could combine their capital and provide the technically trained experts to direct the labor for development and manufacture. The utilization of the water power at Muscle Shoals in developing the mining and manufacture of raw materials will make available to the manufacturing centers of the country cheaper raw materials and increased advantages for the successful production of what they are manufacturing. With the Government's expenditure at Muscle Shoals, which would be a loss if not completed, and with an offer from a man who has proven his capacity and has ample funds to carry out his plans, and where the completion of the project would result beneficially to the entire country, I can see no reason for not accepting Mr. Ford's offer.

There is an immense army of unemployed in the country. Men who were profitably employed before the United States became involved in the World War, and were drafted into the service of the country, are now in great numbers out of employment. They were discharged at the close of the war, without provision for their employment. Many of them gave up good positions to enter the Army or to go into some one of the war industries so necessary in the successful conduct of the war. They are now scattered in all sections of the country without work. Such an army of unemployed is a menace to the entire country, and any project the development of which promises to relieve this condition should, by all means, have the encouragement of the Federal Government. There is no doubt that the completion of Muscle Shoals and its operation as planned by Mr. Ford would be a great step in relieving this condition of unemployment, in that it would give employment direct to a large number and would be the means of stimulating industry in the entire country to the point where all the unemployed could be utilized, and a menacing condition done away with. It would be a distinct service to the unemployed in their extremity. I know that the completion of the Muscle Shoals project, with the revival in industry which would result in the South, and would spread to the whole country, would have the hearty and unreserved approval of the people.

Further, you are all familiar with the fact that it was just a few decades ago that 85 per cent of our population was agricultural. Now, it has reversed itself, and almost 85 per cent of them have left the farm.

We have all got to be fed. Anything that will make conditions better for the agricultural classes, for maintaining production by a smaller force, should have our very careful and considerate attention.

I thank you.

The CHAIRMAN. How many men would be employed—can you tell us?

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Mr. PECK. Only in a general way. I would not be in a position to go into detail, but a project of that magnitude, and the industries that will naturally result, would relieve the situation very materially.

I thank you.

The CHAIRMAN. I am much obliged to you, Captain.

Governor, who is the next witness that you desire to call?

Governor TAYLOR. I believe we are through, Mr. Chairman.

The CHAIRMAN. Is there anyone else who wants to be heard?

Governor TAYLOR. We have a manufacturer, a distinguished gentleman who resides in Chattanooga, Mr. Kreusi, who I would like for the committee to hear for a few minutes.

The CHAIRMAN. All right. Mr. Kreusi, we will be very glad to hear you.

STATEMENT OF MR. PAUL KREUSI, CHATTANOOGA, TENN.

Mr. KREUSI. This is quite unexpected, I assure you, as I did not expect to speak before your committee.

I am a manufacturer of electric furnace products at Chattanooga.

The thought I want to impress upon you is this, you do not need any reminder, the Committee on Agriculture does not—I do not believe this committee should give serious consideration in connection with any project in reference to Muscle Shoals that is not primarily connected with the needs of agriculture, and, as I understand it, the only proposition yet before either branch of Congress, that has thought of the need of agriculture, is the project of Henry Ford.

Other people and other interests talk about developing the power and using the power for their purposes, but Ford is the one man that comes and makes the statement that he will use as much power as that plant, built by the Government at an expenditure of $105,000,000, as much as that will consume, and that certainly will benefit the agriculture of the United States. That is the only proposition before you, and the only one that will come before you. The only proposition is the Ford proposition to operate the nitrate plant, and produce fertilizers of the present type, and also new ones. It is the only proposition that insures some relief to the farmers, and it will therefore reduce the cost of living for all the people of the United States.

The CHAIRMAN. It is true that there is no proposition officially before us, but I notice in the newspapers that the Alabama Power Co., a corporation of Alabama, has made a proposition.

Mr. KREUSI. It is a New York corporation.

The CHAIRMAN. Do you know anything about their offer?

Mr. KREUSI. I have no hostility or interest in that corporation, and what I say is unprejudiced. I have read the digest of their offer in the New York Times, and I can not see anything in it that could interest this Senate Committee on Agriculture. They offer in brief to take over these power plants for their own commercial purposes, to sell and control the power in the South, but they do not undertake to operate the nitrate plant.

They say they will turn back to the Government such power as the Government might need, secondary power, that they will turn back to you such an amount as you may need, if you want to operate the nitrate plant, but they do not say that they will operate the nitrate plant and produce cheaper fertilizer for the farmers and consumers in the United States.

The CHAIRMAN. In the newspapers I have noticed that there was a claim, I think conceded by some of the representatives of the Government, at least so the paper indicated that I read, of the Alabama Power Co. as to the title to one of these projects, or part at least, some portion of the Muscle Shoals project, that the Government was improving. Do you know anything about that?

Mr. PECK. Only what I read in the newspapers. It is a legal question which I think this committee, in fact the committees of both Houses of Congress, would be safe in leaving to the legal department of the Government. A layman like myself could not pass an opinion, an intelligent opinion that you gentlemen should listen to as to the merit of that controversy. If there is any legal question involved, I would do as we do as individuals, if we want the opinion of a doctor we call an expert physician, and if we want the opinion of a lawyer we go to a lawyer, and as I understand it the War Department was advised as to what its rights are by the Attorney General, and I would prefer not to discuss it.

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Senator RANSDELL. Are you familiar with nitrate plants in the world which are making nitrogen to use as fertilizers in agriculture?

Mr. KREUSI. Not personally. We know, in round numbers, that 1,000,000 horsepower are employed in Norway and France, and also in Japan in the manufacture of such fertilizers. Germany also uses hydroelectric power very extensively.

Senator RANSDELL. And it has been successfully carried on?

Mr. KREUSI. Yes, sir; it is an old story.

Senator RANSDELL. It is not new or anything visionary?

Mr. KREUSI. Not visionary at all; not at all.

Senator RANSDELL. It has been demonstrated time and time again?

Mr. KREUSI. Absolutely. It is done right here on the imaginary line that divides Canada and the United States.

Senator RANSDELL. Have not the Canadians done it successfully?

Mr. KREUSI. Yes, sir; for years.

Senator RANSDELL. Have you any idea of the cost of nitrogen as compared with Chilean nitrates?

Mr. KREUSI. No, sir; I would not undertake to discuss that, but it is evidently possible; practical and possible to compete with Chilean nitrate, I submit, or the Canadian companies would not be in business.

Senator SMITH. It might be well in that connection to state that the Niagara company ship their products to the Atlantic Seaboard in competition with the Chilean nitrate, and it has been used in large quantities in compound and commercial fertilizer.

Mr. KREUSI. That is well known to be true.

The chairman made a very interesting point a minute ago. I pricked up my ears. He asked if this was not an iceless region. That is a point for your consideration. It is a fortunate accident, of course, of nature, this great plant, with the largest potential hydroelectric development in the United States east of the Mississippi River. This plant is located so that it is not affected by climate, so that there is no interruption by ice, as there is in many northern operations. It is never closed by ice. You can rely on it to produce the power year in and year out.

In another committee yesterday—the committee of the House—the question was asked of Governor Taylor as to the navigation of the Tennessee River, as to whether there was any obstruction to navigation before this dam was partially completed. The governor, perhaps, did not emphasize as much as he might have that we did have navigation on this river of a sort until the Government obstructed the river by the building of this dam.

You gentlemen understand that there is a stretch completely across that river now, a dam, the concrete portion of which comes up to the general level of the river, so that we can not get up or down. We can not transport our products any more. I used to be able to ship my products to Chicago, etc., and we would save our shippers $1 a ton and still make money. We had two packet lines operating to Chattanooga, connecting up with the Mississippi River and the great territory that the Mississippi River serves, and we saved the shippers $1.50 a ton on pig iron alone, and we could make money in doing so, as compared with the all-rail rates.

What is the position the Government occupies to-day? You have obstructed the sixth largest river on the continent.

We had 652 miles of partial navigation on that river until you put the dam there and stopped us. The only interruption to navigation was that we would occasionally have the water so low that we could not get by there at Muscle Shoals, but we could figure on eight and a half months of navigation.

Senator HEFLIN. There never was any doubt about the sufficiency of the water in the river, but it was spread out, and this dam, when completed, would make the river navigable for 17 miles.

Mr. KREUSI. Yes, sir; and remove the only serious present obstacle to navigation.

The CHAIRMAN. I am interested in that point. I think it is important from a governmental standpoint. I would like to get a little fuller information as to how much traffic this dam, partially constructed by the Government, has cut out.

Mr. KREUSI. I would like you to permit me to file a little statement with you in written form. I can get within a few hours or a few days' time from the chief engineer's office, or the Department of Commerce complete and reliable information as to that. I have had it heretofore.

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The CHAIRMAN. I would be very glad for you to do that. If the Government, by means of this partially constructed dam has interferred with your navigation——

Mr. KREUSI (interrupting). You have reason to?

The CHAIRMAN (continuing). It is morally obliged to complete it or tear out what it put in.

Mr. KREUSI. I am glad you recognize that moral obligation. I would like to emphasize that a little bit.

Some years ago the Senate and House passed a bill permitting the Chattanooga citizens to dam the same stream 33 miles by river and 19 miles by air line from Chattanooga to Hales Bar. That dam was constructed by a special act of Congress, which cost $58,000,000, and it backed up that water, and made a great lake, giving us magnificent navigation through the second worst portion of the river.

In the days when General Grant blockaded, or laid siege to Chattanooga, and when it was necessary for him to come up with food, he had to wind a cable around a tree and pull a boat up a certain distance, and then unwind the cable and take it to a tree farther up and keep on pulling the boat up in that manner, pulling the boat through the rapids. Now, those rapids are gone.

The point I want to make is this:

When the proponents of that measure appeared before the committees of the House and Senate, and offered to remove this obstruction at Hales Bar, which was the second worst obstruction that there was to navigation, this obstruction has been removed successfully.

I use 6,000 horsepower ordinarily in my electric furnace operations at Chattanooga. When they offered to do these things Mr. Burton, and other members of the Rivers and Harbors Committee created a moral obligation that you, gentlemen, ought to carry out. They made the statement that if we would finish the project at Hales Bar, they would do the same thing at Muscle Shoals.

The CHAIRMAN. Is Muscle Shoals above Hales Bar?

Mr. KREUSI. No. It is about 100 miles from there.

The CHAIRMAN. Hales Bar is between Muscle Shoals and Chattanooga?

Mr. KREUSI. Yes, sir; and the head of navigation. Hales Bar has been in successful operation since 1913 or 1914.

The CHAIRMAN. Let me get the understanding right, and I am afraid I might disclose my ignorance of geography when I do it. Does this obstruction at Muscle Shoals prohibit the use of the river at Hales Bar?

Mr. KREUSI. The dam stretches from shore to shore. We have a stream like the Hudson River from Muscle Shoals to the Ohio.

The CHAIRMAN. How far is that?

Mr. KREUSI. Five hundred miles.

The CHAIRMAN. Hales Bar is on the upper side?

Mr. KREUSI. Hales Bar is on the upper side; yes, sir. From Hales Bar down we have something now for which we will not have to come to you any more and ask for money. The Tennessee River is the sixth largest stream in the United States.

The CHAIRMAN. How far above Muscle Shoals is Hales Bar?

Mr. KREUSI. I should say 100 miles above Muscle Shoals is Hales Bar.

This will give you a better idea: By a freak of nature, Birmingham, Memphis, Nashville, and Chattanooga are about equidistant from Muscle Shoals. It is approximately 130 miles by transmission line—what would be 130 miles by transmission line—from Muscle Shoals to Chattanooga, an easy transmission distance for electrical power for all the great cities.

Now, Mr. Burton and his associates on the committee said that if we were to complete our part of the project, they would do the rest; and instead of doing that, they have thrown a dam across the river from here to here [indicating], not finished so that we can get any power; and the way they have managed it is absolutely putting a cork in the neck of the bottle, and we can't get up or down stream; and we can never resume our river navigation—we can not resume until they blow up that dam across the river or finish it.

Senator RANSDELL. That dam was put in by the Government as a war proposition, was it not?

Mr. KREUSI. Yes, sir.

Senator RANSDELL. There were several locks and dams there which gave a canalized navigation over that river.

Mr. KREUSI. Yes, sir.

Senator RANSDELL. Built by the Government?

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Mr. KREUSI. Taken over by the Government.

Senator RANSDELL. Taken over by the Government and built by private people. You are right about what you said about Mr. Burton. We did create that moral obligation, because there was considerable navigation up this river prior to the building of this great lock and dam, which is now incomplete.

Mr. KREUSI. Yes.

Senator RANSDELL. And when this present project is completed, it will drown out all of the works which we have been using.

Mr. KREUSI. Which are obsolete.

Senator RANSDELL. And give you a modern, up to date navigation, as compared with the inferior navigation heretofore. You did use it and carried freight on it, did you not?

Mr. KREUSI. A very tremendous tonnage.

Senator RANSDELL. But you will have a very much better river when this is completed?

Mr. KREUSI. For the first time we will have a river that I would say, under the modern conditions of to-day that it is practical to operate. We will have a fine navigable rvier, and can use steel barges on it as the Government does on the Mississippi River, and can navigate over that region from Chattanooga to Paducah, and enter into the Ohio and Mississippi.

Senator RANSDELL. You can do this for 12 months in the year, too, can you not?

Mr. KREUSI. Every single day of the year.

Senator RANSDELL. Is there not a great deal of potential commerce adjacent to that river?

Mr. KREUSI. Yes, sir.

Senator RANSDELL. Of the heaviest kind of freight?

Mr. KREUSI. Yes, sir; coal, iron in the finished form, etc.

Senator RANSDELL. Marble also?

Mr. KREUSI. Marble in great quantities, phosphorus from the great beds in Tennessee. The possibilities of commerce on that river stagger the imagination.

Senator RANSDELL. The navigation problem is important in connection with the other problems there.

Mr. KREUSI. It is second only to the agricultural problem. I am interested in the navigation features of that stream, but I think the dominant thing, the big thing, is the possibility of bringing down the cost of fertilizers, and so increasing their use in the United States, by the utilization of that hydroelectric power in the manufacture of fertilizer, and it is something, when completed, which will reduce the cost of fertilizers very materially.

Senator RANSDELL. You will then carry that fertilizer by water instead of by rail to other States?

Mr. KREUSI. Yes, sir; we will carry it by water to Illinois and Iowa, and the other States, but Illinois and Iowa will get this fertilizer by water, which is the cheapest kind of transportation.

Senator RANSDELL. They fit together?

Mr. KREUSI. They fit together; yes.

Senator RANSDELL. Cheap fertilizers and cheap transportation fit together.

Mr. KREUSI. Yes, sir.

These locks were built about in the year 1827 by the State of Alabama, and then our Government exercised control over such rivers as they desired, and they then made the State of Alabama get off the track, and they were built and finished about 1875. I may be wrong about the date, but that would not be essential, the completing of these canals and locks to which you refer. Before this dam was built across the river we managed to get along with navigation in all but the dryest seasons. We operated our boats for eight and a half months in the year, and did it successfully, and performed a service in the farmers' interest, and when this is now completed a service will be performed for the farmers all over the United States, because they will get cheap fertilizers by that cheap kind of transportation, namely, water. We did that successfully; that is, navigating the river, until the middle of the war. We thought it would be finished. The Government should not start something that they do not finish. They put that dam across the river. I say this: "You are dogs in the manger," meaning the Government, and not casting any reflection on the committee, "Either get out of that river and turn it back to Alabama and Tennessee and we will build these plants and operate them all, but, if you are going to control navigation in these rivers, finish what you have started."

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Senator HARRELD. Are those dams that you built in 1875 still there?

Mr. KREUSI. Yes, sir. They will be 50 or 60 feet under the surface of the water by the time the Government finishes the Wilson No. 2 Dam.

Senator HARRELD. If this obstruction were removed, would those dams be useful?

Mr. KREUSI. Yes, sir; they could be.

Senator HARRELD. Let me ask you another question. How much did the Government expend on Muscle Shoals from the time they took it over up to the present time?

Mr. KREUSI. You mean including the various experiments at nitrate plants, lime quarries, power plants?

Senator HARRELD. Everything.

Mr. KREUSI. I think it is $105,000,000. There is, however, no use crying over spilled milk. The only thing to do is to complete it.

Senator HEFLIN. The Government has not wasted a dollar if this is completed?

Mr. KREUSI. No, sir.

Senator HEFLIN. If they make fertilizers in time of peace and make that river navigable from Hales Bar down——

Mr. KREUSI. Yes, sir. You will assume charge of the river. Why not do it now?

Senator LADD. You referred to the phosphate. Can you tell us anything about the deposits there, the amount available, and so on?

Mr. KREUSI. In the middle of Tennessee, with Columbia as the head, are the largest commercial beds of phosphate in this country, second in importance, and a close second, to those of Florida.

Senator HARRELD. That is nowhere near this river.

Mr. KREUSI. Not more than 40 miles from Muscle Shoals. It is only 50 minutes from Nashville down.

Senator SMITH. Is it not true that the phosphates in Tennessee are richer than those of Florida?

Mr. KREUSI. Yes, sir.

Senator SMITH. I know that my State was third in the production, or in the amount of phosphate rock, but Florida was superior in the phosphorous content to us, and Tennessee was the richest we have been able to discover yet.

Mr. KREUSI. I believe that to be true.

Senator LADD. The utilization of this water power in connection with the development of phosphates should reduce the cost of fertilizer?

Mr. KREUSI. Yes.

The CHAIRMAN. As I understand it, the phosphate could be used to make a complete fertilizer.

Mr. KREUSI. Yes, sir. I am not trying to read Mr. Ford's mind, but I am sure he will make compounds and make a complete fertilizer—a completely balanced fertilizer—and the farmers will not have to pay freight on dirt. He will make it balanced so they can ship it all over the country, and it will travel by the cheapest transportation.

The CHAIRMAN. If they get their dirt from the right place—from Nebraska, for instance—they will not need any fertilizer.

Senator CAPPER. I am interested in this Ford proposition. I look upon it with great favor because of the relief it will bring to the agricultural interests of the country, especially the South. The fertilizer problem does not concern my section, but we are told that there is a fertilizer trust. I hear that from a good many sources.

I would like to know whether there is in your section evidence of a fertilizer trust, how it is operating or working, as to the interests of the farmers there, and what relief you think would come from this project if carried out successfully, so far as putting the fertilizer trust out of business?

Mr. KREUSI. I am not a dirt farmer and am not familiar with the operation of the fertilizer manufacturers. I would not be able, out of my knowledge, to answer that question at all. I am sorry, but I know nothing about it.

Senator CAPPER. You hear that statement made?

Mr. KREUSI. Yes, sir; I have heard it made, but I do not know anything about it.

Senator HARRISON. This dam is two-thirds completed?

Mr. KREUSI. Two-thirds in the difficult part, but not measured in cubic yards. The difficult part is all done, and all the questions of an uncertain bottom, and all questions of uncertain locks have been solved. The great foundation, which

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is enormously broad—that is all built, and clean across the river; so while in cubic yards the engineers would tell us it is somewhat less than half complete, the difficult part is completed, and the rest is child's play.

Senator HARRISON. Do you know the percentage of the estimated amount to complete the project?

Mr. KREUSI. No, sir. I understand that you will have many Government engineers here to give you that information.

Senator HARRISON. My impression was that it was two-thirds.

Senator HEFLIN. Mr. Kreusi, I wish you would state to the committee the length of the dam.

Mr. KREUSI. It will be the longest concrete dam in the world—4,700 feet, as I remember the figures—the longest in existence.

Senator SMITH. They found some difficulty, did they not, with the foundations of the previous dam that was built?

Mr. KREUSI. Yes, sir; at Hales Bar.

Millions of dollars were lost because they did not do the work like the engineers did at Muscle Shoals. At Hales Bar they made some drillings and went ahead on the assumption that the bottom was good; they went ahead on the theory that the drillings showed that the bottom was good, and they proceeded with the dam. They found a lot of rotten limestone. That is a limestone country. They found so much that they had to go deeper and deeper, and they spent more money at Hales Bar than was contemplated, and contrary to that at Muscle Shoals. The Government, with extraordinary thoroughness, had the Army engineers make drillings and borings until they found a location which they believed was safe on which to put the foundation, and all their subsequent experience showed that they were justified in making these borings and in the care they took. That part of the dam is finished. It is nothing but child's play now. The dam at the present time comes above the water.

Senator HARRISON. In the previous discussion of this subject quite a lot was made of the fact that the previous dam that was constructed had gone out on account of the insufficient base or insecurity of the foundation.

Mr. KREUSI. No dam has ever gone out or threatened to go out.

Senator HARRISON. As I understand it, the Government laid the foundation and completed all the substantial work.

Mr. KREUSI. The substructure is complete.

Senator HARRISON. So the only thing to be done now is——

Mr. KREUSI (interrupting). The only thing to be done now is to carry it up in the air.

Senator KENDRICK. Do you know how much higher they propose to carry the dam?

Mr. KREUSI. The dam is to be about 97 feet high above the general level of the river.

Senator KENDRICK. It is already above the water.

Mr. KREUSI. Yes, sir; depending on how high the water is when there are freshets.

Senator PAGE. I understand that you have a correct idea of the amount we shall probably have to appropriate to complete this work. How much from the Federal Treasury do you understand is to be appropriated now under the plan, or under the Ford offer?

Mr. KREUSI. I am not associated with Mr. Ford. I am only a private manufacturer at Chattanooga, coming here at the request of Governor Taylor to help, if possible. I understand that Mr. Ford contends that from $40,000,000 to $42,000,000 will complete the dam under consideration. This will do everything that you gentlemen have to do; in other words, while the Chief of Engineers or the engineers representing the Government are always very, very extraordinarily conservative, they estimate that it will cost $50,000,000, while Mr. Ford estimates it will cost from $40,000,000 to $42,000,000, a difference of opinion of only $8,000,000. If I were betting I would bet Ford would build it for less than $40,000,000.

I am not an engineer and no concrete contractor, but I believe there would be a lot of money made in building that for $40,000,000. I venture to say that Ford's engineers are safe in estimating $40,000,000 will finish everything in sight down there. That is no criticism of the Government engineers, who must work on the side of safety; but there is only $8,000,000 difference in their estimates.

The CHAIRMAN. That is a small item when you consider how we have been figuring in the billions.

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Mr. KREUSI. It is small when you compare it with the cost of a new battleship, which costs at least $40,000,000. In 10 years the battleship is gone. If you put $40,000,000 here you have conferred a benefit upon posterity. It is always there safe, and conserving money.

Then, here is the great difference: Every time we take a ton of coal out of the ground we rob posterity of coal, and every time we let the waters of these great streams, like the Tennessee, Mississippi, and Ohio, waste themselves into the Atlantic or the Gulf of Mexico, that is economic wealth wasted, but when we conserve them and use them, we are piling up increased taxable wealth, for the country, and benefiting the country for all time.

The cost of one battleship will finish the whole thing, and when it is finished you have something for all future generations, but, in the case of a battleship, it goes to scrap in 10 years.

Senator SMITH. In case you wanted to build another battleship, you have the elements there to make the battleship effective, in the form of nitrates.

Mr. KREUSI. Yes, sir.

Governor TAYLOR. I desire to present a young man from Tennessee who has had quite an experience abroad, spending 18 months in France, Major Campbell.

The CHAIRMAN. Will you please give your name and occupation, Mr. Campbell?

STATEMENT OF ROBERT M. CAMPBELL, BUSINESS ORGANIZER, JOHNSON CITY, TENN.

Mr. CAMPBELL. There have been a number of objections urged against the Ford offer. I want to say that the people I have been in touch with have not batted an eye, a single one of them.

I noticed your remark about your interest in this fourth proposal to lease Muscle Shoals, Mr. Chairman. It comes from the Alabama Power Co., and was announced this morning.

If I wanted to delay action on the Ford lease, or defeat it, those are the very tactics I should pursue. I would create a diversion and form a syndicate of men whose names are known in the financial world, and I should submit a proposal which left nothing to be desired. What would it be worth? Of course, we know that Mr. Ford has a great many enemies, but he has a record for doing things, and his record is more assurance to us than we feel the Government can contrive in any way to give us. They say, "Will he make fertilizer?" "Will he guarantee to make fertilizer?" We feel that if Mr. Ford can not do it, it can not be done.

So we believe that these objections that are raised are hardly entitled to consideration in any case.

That is all I care to say.

Senator KENDRICK. Would you assume it might be possible, while he could make fertilizer, he might use the power there for some more profitable business, and don't you believe we should have some assurance that he was going to produce, or employ a reasonable part of the power in the manufacture of fertilizer?

Mr. CAMPBELL. I think he might use this power for any other purpose, but I do not think he will. I think in this matter we must exercise some confidence in Ford, and I think we are warranted in doing that, because, as was pointed out by the governor of Tennessee this morning, Mr. Ford's ambition can not any longer demand money. He must want to perpetuate the Ford name and build a monument, and he sees this opportunity to lay the whole country under obligation to him.

Senator HARRELD. Under the terms of this agreement he can not make fertilizers and sell them at a greater profit than 8 per cent.

Mr. CAMPBELL. That is right.

Senator HARRELD. What assurance have we that his successors will have the same desire to view the matter as you suggest? Is it not true that he could make more money out of anything else than 8 per cent, and is it not possible that his successor will want to make that money and not make fertilizer?

Mr. CAMPBELL. Nothing; but I trust Mr. Ford.

Mr. HARRELD. That is the point.

Mr. CAMPBELL. You have to trust somebody.

The CHAIRMAN. The point that the Senator makes is that Ford is not going to live for a hundred years.

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Senator HARRELD (continuing). Granting that he has this ambition; look at this as a commercial proposition and not as an altruism.

Mr. CAMPBELL. That is the actuating motive with Ford to-day.

Senator HARRELD. It may be, but his successors will not have it.

Senator RANSDELL. Will it be possible to have a contract stating that a part of that power shall be used in the manufacture of fertilizer? Will they be willing to do that?

Mr. CAMPBELL. If you can find anybody to do it, if you can get any bona fide offer to do it, then Mr. Ford will meet the offer, unquestionably.

Senator HARRELD. I would feel a whole lot better about it if he would do it.

Senator RANSDELL. He contemplated to do it, as I understand, and he would be willing to bind himself and his successors, so far as he could, by contract.

Mr. CAMPBELL. I do not know anything about that. I applaud Mr. Ford's course in standing firm right now, and in saying that he will not yield an inch, because if he begins to yield now his cause is lost.

Senator HARRELD. Is it not possible that the 8 per cent profit clause in there is detrimental to the contract? Would it not be better if it were stricken out and leave them to compete in the manufacture of fertilizers?

Mr. CAMPBELL. Yes, sir; I think that is true. I think the contract could be improved in many ways, but I think the contract as it stands is well worth accepting. It may not be the best proposition, but it comes from the best proposer.

Senator HARRELD. Is it not possible that the 8 per cent provision will defeat the very purpose of the bill, so far as making fertilizers is concerned?

Mr. CAMPBELL. I would not claim that it is the best possible form, or that it is the best you might receive, but I do think the Government will be wise in accepting that contract. Of course, if they can improve it some, very well, but not let it fail on account of some technicality.

Senator HARRELD. I am not raising a technicality. It strikes me if you put that 8 per cent in there it will not be as desirable or effective, so far as the manufacture of fertilizer is concerned as it would be if you did not limit them to 8 per cent.

Senator SMITH. I am not familiar with that form of the contract. Was that 8 per cent clause put in by Ford or the department?

Senator HARRELD. It is in Ford's proposition that he will produce these fertilizers at not exceeding 8 per cent profit, but there is no binding obligation on him to produce fertilizers at all, and necessarily his successors would go on producing something else. It might defeat the very purpose of it.

Senator HARRISON. Mr. Chairman, it seems to me that some one ought to come before this committee and explain to this committee what Ford wants, and the sooner we get to it the better.

The CHAIRMAN. We will have that done, and it should have been done first. We will meet to-morrow at 10.30 o'clock.

(Whereupon, at 11.40 o'clock a. m., the committee adjourned until to-morrow, Friday, February 17, 1922, at 10.30 o'clock a. m., for the consideration of other matters.)

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MUSCLE SHOALS.

MONDAY, APRIL 10, 1922.

UNITED STATES SENATE,
COMMITTEE ON AGRICULTURE AND FORESTRY,
Washington, D. C.

The committee met, pursuant to call, at 10.30 o'clock a. m., in room 224, Senate Office Building, Senator George W. Norris presiding.

Present: Senators Norris (chairman), McKinley, McNary, Capper, Gooding, Norbeck, Harreld, Kendrick, and Heflin.

The CHAIRMAN. The committee will come to order.

The origin of the Muscle Shoals investigation came about by a provision of law, section 124, approved June 3, 1916, the same being an act for the making of further and more effectual provisions for the national defense.

This section provided for the increased manufacture of explosives in time of war by fixation of nitrogen from the air and gave authority from the President to locate the plant or plants. The President located them at Muscle Shoals in an official letter dated February 23, 1918.

The Government has spent nearly a hundred million dollars in the improvement down there in the way of machinery and improvement of the river.

We wanted to start out this investigation by the committee by having the engineer in charge of the work at the Government dams there, Colonel Barden, testify. The colonel is here, but before he takes the stand the Senator from that State, Mr. Underwood, is present, and I think it would be proper for him, perhaps, to offer his testimony in the way of an introduction before we start the actual investigation by witnesses.

Senator Underwood, we would like to hear from you.

STATEMENT OF SENATOR OSCAR UNDERWOOD, FROM THE STATE OF ALABAMA.

Senator UNDERWOOD. Mr. Chairman, I am very glad to have the opportunity to say a few words in reference to this very important question. It is not that I am as well qualified to tell the committee the details of the project or the technical information that they will desire to have, as many other gentlemen in the room, because I am not at all a technical man or have not technical knowledge to advise the committee; but I am very much interested in this proposition, and have been for a number of years.

I took a very active part some years ago in the House in trying to secure—and did secure through the House—passage of a bill to establish a nitrate plant to make nitrogen out of the air in this country, instead of relying on the peculiar nitrates.

I was very much interested in the amendment to the national defense act, which is the basis of all this investigation at Muscle Shoals, when it passed the House or when it passed the Senate and became a law some years ago. Of course, I am interested very much in the development of the Tennessee River as a navigation project. I am very much interested locally, as it is my home State, in the development of hydroelectric power, inasmuch as it will build up the State; but primarily, Mr. Chairman, from the very beginning my chief interest in this matter has been in the development of nitrogen as produced from the air—air nitrogen.

I realized a good many years ago that unless we did do something to bring back the depleted soils in this country we were going to be in a very serious condition from an agricultural standpoint. I remember when I was a boy and lived in the Northwest, on those great virgin fields in Minnesota, the prairies up there, that I have seen green wheat fields blowing like billows in

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the sea as far as the eye could see across the plains, and my recollection is that at that time those fields produced from 40 to 50 bushels of wheat to the acre. I understand now the production per acre has fallen off to something like 15 and 20 bushels, simply because the soil is depleted. They can not plant legumes in that country. When you get close to the Canadian line cattle raising is not profitable, as it is further south, and they can not diversify their crops because the corn does not grow that far north. Now, that is only an extreme illustration from that end of the line. Of course, the day will come, if artificial fertilizer of some kind is not put into that soil to renew it, when it will be thoroughly depleted and the country depopulated. It may be 100 years from now, or 150 years from now, but the day will come, if artificial fertilizer can not renew that soil in the far Northwest, when the people will have to move out because they won't be able to produce a living.

Now, I have spoken of that first, because I lived in that country at one time, and knew it pretty well. That far northwestern country had an advantage over the fields of the South. It is covered by snow in the winter, and the fertility of the soil is not washed off like it is in the Far South. We have great advantages over the soil in the North because we can plant legumes. We can diversify our crops. We can raise cattle. We have a number of ways of replenishing our soil in the South that they do not have in the Far North; but we have one great disadvantage in that when the winter rains fall they wash the fertility off the soil and unless it is protected it goes out to sea, and that fertility has to be renewed in the way of fertilizer. So that I have regarded this question, Mr. Chairman, of the renewal of the fertility of the soil as one of the foremost questions that confront the American people. The question of the maintenance of an Army and a Navy for national defense is not of greater importance than is the providing for ample, cheap, and satisfactory means of refertilization of depleted soils.

Of course, we know every man who has studied the situation, that in large portion European agriculture is in an intensified form, and that there is a vast deal of fertilizer, in one way or another, goes into the soil. We know that in Germany the very method that has been suggested here has been tried and successfully tried, and the fertilizers are made out of the very products that can be made now at Muscle Shoals if you turn the wheels.

Now, I do not contend, Mr. Chairman, that this one project is going to supply the needs of all the people of the United States, but I do contend that the Government has got to demonstrate that this project is a success and can be successfully carried on before you will get any other money in the United States to go into the question of making air nitrogen and producing fertilizer by that method, because as long as it stands there they will say it is a failure.

Now, I do not come here to throw any rocks or to differ with any of my friends, but I come here to ask you to look the question right in the face. You know a year ago, or a little over a year ago, the Senate of the United States provided the money to finish this Dam No. 2—that is, the necessary amount of money. The first appropriation was $10,000,000, and we provided for a bill to put that nitrogen plant in operation. Of course, we had a fight in the Senate. We had differences of opinion. I am not here to criticize anybody's opinion that does not agree with us, but I am going back to this proposition, Mr. Chairman. It was the opponents of this proposition who said that it was an absolute waste of money to finish that dam or to operate that nitrate plant—an absolute waste of money—and in the House of Representatives the project failed. The wheels of that plant have been closed for a year. They have been closed for this length of time. They were closed before that. The work on the dam would be nearing completion if, for want of money, it had not been stopped at that time, and, of course, there is a great attendant loss to the Government. If they were right, and it was a waste of money, of course, it ought to have been stopped or to have been junked; but if it is not a waste of money then the Congress of the United States ought to take charge of this matter and put the whole plan through in the most effective way it can at the very earliest moment.

So, of course, I know that there are many people in this country who are opposed to this development. There are a great many people in this country that are opposed to making fertilizer at Muscle Shoals because they think it conflicts with their business. I am in the business myself where a good deal of opposition comes from. I have not got so much of this world's goods, but most of what I have is invested in the pig-iron business, and we make a by-product, and most of the by-product people in the United States are opposed to the

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development of this nitrate plant at Muscle Shoals because they think that it will create competition with their business, and they do not want the Government to compete with them in business, or they do not want the Government to turn this plant over to some private individuals to compete with them in their business.

I am not criticizing anybody, but that is a fact that we all know. Those gentlemen have a perfect right to express their opposition, but it is up to the Congress to know whether they think that the stopping of this work in order that they shall not be competitive with some special interest in the country is better for the people of the United States or whether this problem is of such great and momentous importance in the way of revitalizing the lands of the United States and producing cheaper food for the people of this country that Congress should take hold of it and put it through regardless of what opposition may come to it. That is the real question. It is not a local question.

When the national defense act was passed they did not name Muscle Shoals as the place to locate this proposition. It was located at Muscle Shoals because the President and his advisers came to the conclusion that that was the best available site in the United States to establish a plant of this kind; and although I know there are greater powers in the Rockies and the far West, the transportation from them is very difficult, and I am satisfied that every man who has now studied the question realizes that when you take into consideration the transportation from the great water powers of the West to the East, and take into consideration the available amount of water power that can be produced by the money invested, everybody will come to the conclusion that the President of the United States, acting through the War Department, was right when he was ordered to locate a plant to make air nitrogen, when he located it at Muscle Shoals. So I think that that problem has blown by.

Senator KENDRICK. Do you know whether the people in that section were especially interested in having the plant located at Muscle Shoals?

Senator UNDERWOOD. Of course, they have dreamed it for a hundred years. They have dreamed this proposition of this great river, that navigation had been stopped by nature at Muscle Shoals, and, later of the great power that was there. It is the dream of their lives. But I am not arguing it from this standpoint, and I know you are not looking at this problem from the standpoint of the people of Alabama, because it is altogether too big a problem for that. It is either a great national problem or it is nothing. Of course, as I said, the Government has blocked the navigation of that river. I think it is up to the Government to give an open navigation, but that is one of the minor details.

The Government has built a hundred million dollar plant there to make nitrogen in time of war. It could lay there until another war comes without serving the people of this country; but what I came to this committee to say is the great problem here is to serve the American people by producing fertilizer at that plant and demonstrating to the world what can be done. Of course I know that the amount of fertilizer you are going to make at Muscle Shoals is not going to supply the people of the United States, but if you allow it to be developed there and it is shown it can be successfully and cheaply made, and the great agricultural interests of the United States benefited by it, then you are going to have these same plants developed in the Rockies, on the Canadian border, and all over the country where there is available water power to accomplish it; but as long as you put the hand of condemnation of the Government of the United States on this project at Muscle Shoals nobody else will dare go into the business of developing water power and producing nitrogen to make fertilizer for the people of the United States. It is your condemnation, and yet, Mr. Chairman, a year ago there were those in the Congress of the United States and those men in high position in the business affairs of this country that proclaimed—and I have no doubt when they proclaimed it they believed what they said—that it was a waste of money to continue this project; it was a waste of money to develop this nitrogen plant; it was a waste of money to finish the dam, and yet when you would not do it, when the Congress of the United States negatived this proposition and refused to act, and the Secretary of War asked for bids from some individual to take hold of this and finish up what the Government would not do, a man who has been the most successful man in industry in the United States came before the Government of the United States and said, "I will do it if you will give me a chance."

Senator MCKINLEY. Will the gentleman permit a question?

Senator UNDERWOOD. Yes.

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Senator McKINLEY. Did not that gentleman ask the Government to spend $10,000,000 of its money before he would do it?

Senator UNDERWOOD. Mr. Ford's proposition, as I understand it, is for the Government to make this development on a scale where the entire navigation would be open, where you can utilize to the highest degree the electrical power, because, of course, if you build only one dam your electric power development, even at that dam alone, will not be commensurate to what it will be if you build two, with the necessary reservoirs involved. His proposal is that this should be developed on a scale where it could really be made useful to the American people, and of course the proposal of the Government was that he was invited in to make this kind of proposal. Mr. Ford did not make the proposal for Uncle Sam to go down in his pocket and put up the money, but the Government of the United States proposed, not to Mr. Ford, but to anybody else that would come here and take this contract off their hands, that they would put up the money to finish it, provided the man who made the proposal would contract to and would pay them back their money with a rate of interest on it.

Senator McNARY. Is not the true situation in regard to that matter that the people of the South who desired the plant completed invited Mr. Ford to come down, and his engineers, to look it over, and he first refused and finally came down at the earnest solicitation of the people of the South?

Senator UNDERWOOD. No, sir; I do not so understand. I will tell you what the facts are.

The CHAIRMAN. Now, gentlemen, let me suggest it was my idea that before we took up any of the propositions, not only Mr. Ford's but several others, to get through with the experts who would show us just what we had down there nok. That is the reason I wanted to start out with Colonel Barden, who has charge of the dam proposition down there, and then when we get through with him we will take up not only Mr. Ford's proposition, but every other proposition involved in this investigation. So I would just like to suggest that we do not go too much into that phase of the investigation.

Senator UNDERWOOD. I realize that, and I thank you for the opportunity, but I have got to leave town for a couple of weeks, and part of this program will go on whilst I am absent; and I am not going to trespass on your program, but under those conditions, as I am very much interested, probably you will pardon me if I go on for a few minutes longer. I will not take much time.

The CHAIRMAN. All right.

Senator UNDERWOOD. Now, Senator McNary, I know that what you just said is the supposition of most of the people—that the original invitation came from the South to Mr. Ford to come down there.

Senator HARRELD. Suppose they did. What difference does it make?

Senator UNDERWOOD. It does not make any difference. The southern people would have been glad to invite Mr. Ford. But the original proposition to come was not made by the people of the South. I will tell you how the proposition went to Mr. Ford. We might as well have the record straight, and this is a fact, and what I say you can substantiate by General Beach, Chief of Engineers, by the Secretary of War, and by Mr. Worthington.

When Secretary Weeks made his proposal and advertised in the newspapers that he wanted somebody to bid to take over Muscle Shoals as a private endeavor and develop the nitrate plant and the dam, which was all published in the newspapers, among the other people who made inquiry was the chief engineer of Mr. Ford. He wrote to the War Department asking what it meant and what power they had to dispose of, and the Chief Engineer's office—I don't know whether General Beach himself or not—wrote back and explained the situation, and then he said he would like to have an engineer come to his place of business and explain the situation to him. General Beach did not have an engineer to send. He did not have an engineer that was conversant with the facts, but as Mr. Worthington had been conversant with all these facts from an engineering and a development proposition from the beginning, he suggested that Mr. Worthington go up there, and wrote Mr. Ford that Mr. Worthington would come if that would satisfy him. And this I know, because I myself wrote the letter to introduce Mr. Worthington to Mr. Ford, before Mr. Worthington left. He went there and on that invitation laid the facts before Mr. Ford, explained the situation, and Mr. Ford—before the people of Alabama, so far as I know, knew that he had any thought about it—came to Alabama to investigate the proposition himself, and then made the proposal before you.

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Now, I think it would be nothing short of a crime if this Congress of the United States allows the flag to be pulled down on the Capitol and does not provide for the immediate completion of those dams; but I think it would be equally a crime if this Congress of the United States adjourns and does not determine on a fixed and definite policy to operate that great plant down at Muscle Shoals and make nitrogen in order that the people of the United States may have a cheaper and a better fertilizer, regardless of whose business and whose private affairs are affected.

I am not going into a discussion of the Henry Ford proposal this morning, Mr. Chairman, because you do not wish it. Maybe at a later day, if you will give me the opportunity, I shall be glad to go into the details, but I want to say this to the committee: A year ago I was in charge of the bill in the Senate to provide a Government corporation to conduct this plant. I was earnestly in favor of it, and the Senators who agreed with me between us succeeded in passing a bill in the Senate; but I prefer to have Mr. Ford make this development for the Government, and I will tell you why in just a few words.

I think it is the best proposition that has come before the Congress, if we are not looking at our private interests, if we are not looking at it from a governmental standpoint; but if we think it worth while to produce nitrogen in order that the agricultural people of America may have a cheaper and better fertilizer, if that is the standpoint, then I say Henry Ford's offer is the best one for you to take. I am not raising the question of dollars and cents. Why do I say it? Because any proposition that you go at, that you want to carry through, must have management behind it to make it succeed. If you attempt to carry this through, as I attempted, and some others a year ago by a Government corporation, then you have got the question as to whether you are going to have successful management or not to deal with it. But here is a man that I understand is not only willing to pay back to the Government every dollar that this development cost, with 4 per cent interest on it, and give it back at the end of a hundred years, but is willing to put up $10,000,000 of his own in a corporation to secure the development of this nitrate plant, not so much in his own interest, because he has agreed that he will not make over 8 per cent profit on it, but in the interest of the people of the United States; and he is willing to bet $10,000,000 that he makes good; and he is a man that has made good in every industrial proposition he has taken hold of, not only made good but he has got the money and the organization and the power and the force to make good with.

I therefore say, Mr. Chairman, that from my viewpoint, although a year ago I was earnestly advocating a Government corporation, when you have got a volunteer that is willing to risk $10,000,000 of his own money to make good, who proposes to produce fertilizer at a profit of 8 per cent to himself for the American people, I say that the Congress of the United States owes it to the American people that this proposition should be agreed to, and agreed to now.

I thank the committee very much.

Senator McNARY. Just a word, Senator Underwood.

I agreed with you two years ago, or a year ago, that the Government should undertake the fixation of atmospheric nitrogen and go ahead and complete the plant. I heard you speak just as earnestly on the floor then as you do before the committee now advocating governmental ownership. I think some one asked you the question if the Government could operate this as successfully as private industry, and you said more so, on account of the engineering and chemical problems involved. Have you lost confidence in the Government at this time?

Senator UNDERWOOD. No; and if there was some one, Senator McNary, who was going into this proposition as a business to exploit it himself, I should go back to the old proposition that I had, and say that the Government should operate it for the benefit of the American people; but I realize if you are going to take this and develop this dam and take the nitrate plant and turn it over to private fertilizer industry that has had a monopoly for years, for years to come, to use the Government plant to exploit the fertilizer business for themselves and not for the American people, I would stay where I was a year ago and say that you had better do this by the Government, because, Mr. Chairman—I may be wrong—but for the life of this Nation the creation and maintenance of an Army and Navy are no more important for its future life and development of this Nation and these people than it is to provide them with an adequate opportunity for fertilization of their soil; and the reason I stand

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behind the Henry Ford proposition is that that is not his business. He has reached the point in life where I do not believe he is ready to develop this thing from a money-making standpoint, but he is prepared to do a great patriotic act for the people of the United States by limiting the amount of his profits and producing fertilizer for them as cheaply as possible.

Senator McNARY. Referring to the personal equation that enters into it, I think we can all agree here that Henry Ford can not expect to live a hundred years. What are we going to do when Mr. Ford is out of it?

Senator UNDERWOOD. I think this, Senator McNary, that if Ford organizes this proposition, within the next 5 or 10 years, on the basis of this contract that is provided here, with a limited amount of profit; if he starts the organization with a system of production and delivery that he has and that he can make and maintain, as he has demonstrated in the past, when it is started it will, by its own initiative and its force, carry on for the benefit of the American people. This enterprise, no matter how good it is, or how great, its survival or its death is going to depend on personal organization in the end, if you are going to make fertilizer for the American people; and it is not merely a question of manufacture; it must be delivered, and here is a man who has demonstrated that he not only has the power of manufacturing, but he has the power to go right into every territory and deliver the product of his factory cheaper and better than anybody else.

Now, if you think it is more important to protect the by-product industry that I am to some extent interested in, or some other industry, than to look at it from the broad standpoint that these fields of America must be brought back to their original fertility or the life of the Nation can not survive; if you look at it from that standpoint, then any individual that stands in the way is a negligible proposition.

Senator McNARY. Senator, let me ask you this question: I think we can agree, all of us, that the need of fertilizer is great and important to future production of crops in soil whose fertility has been depleted by long periods of cultivation; but don't you realize that this contract calls for 100,000 tons of fertilizer annually, whereas the annual consumption of this country is about 8,000,000 tons, and the adjoining State of Georgia uses three and a half times as much fertilizer as can be made at this plant under Henry Ford's proposition?

Senator UNDERWOOD. I am not going to discuss the details of that, Senator, because I am not clear in my own mind. I have not got sufficient information to do that; but my own understanding is that a good deal more fertilizer can be produced at this plant than has been generally accredited to it. But that is not the proposition. If you fail to produce it at this plant, and successfully produce it, then you put a black eye on the whole proposition, and nobody else is going in. The great water powers in your State—and you have some of the greatest in the Union—will never be developed along this line for the benefit of your people if you fail at Muscle Shoals; but if somebody can prove that it can be done, and done successfully, at Muscle Shoals, in the interest of the people, then you make them flourish all over the United States.

Senator McNARY. I agree with you in that, but I stand where I did two years ago. I have not lost faith in the Government in this undertaking.

Senator UNDERWOOD. Of course that is a question for the committee to decide. I am giving you my viewpoint. I am not criticizing your viewpoint. I am merely saying that the time has come when action is demanded; that we have got no right to wait longer, and that we ought to determine this question before the Congress adjourns.

Senator McKinley, did you have a question?

Senator McKINLEY. Don't you think it is very selfish in the fertilizer trust to oppose this plan when this plant could not possibly fertilize one acre out of every 300?

Senator UNDERWOOD. Well, I think there is going to be room enough. I don't think the development here is going to destroy the fertilizer industry. There is going to be room enough for them to operate. I don't think it is going to destroy the by-product business. I think these people that are in the same business that I am are very foolish people to get up here and spend their money and their time in fighting this proposition when if you would get a cheap fertilizer it would make more demand for fertilizer, and wake the American people up to the necessity of its use. The world has never turned backward by finding a new thing or carrying on a higher development.

The CHAIRMAN. I think it is conceded that in Mr. Ford's proposition the maximum amount of fertilizer that can be made is not provided for. He ex-

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pects to do other things, of course. Now, if the Government, through some instrumentality of its own, works these improvements to their capacity of fertilizer directly, they would produce many times more fertilizer than Mr. Ford proposes to produce. Is not that true?

Senator UNDERWOOD. Oh, I think that is so; but the details of this proposition I am not going into. I take it, your committee will take that question up with Mr. Ford and his experts and the other experts here, and I am not prepared to answer the questions about the details of what you should agree on. I am merely saying that I believe the Ford proposition is the best one. If you can come to a proper agreement about details, of course you will want a good man, a man of great executive ability, who can carry this through to success.

The CHAIRMAN. I agree with everything you have said in regard to the ability of Mr. Ford. I think he is a remarkable man. But I think, like Mr. McNary, that his years of life are not very many now. He will not live a hundred years to carry on this contract. And there is another thing that comes in as very important in the consideration of the Ford proposition, unless he modifies it, and that is the Gorgas steam plant. I don't intend to go into that now, but that has been brought up.

Senator UNDERWOOD. That is another detail, Mr. Chairman, that you have got to take up.

The CHAIRMAN. Of course, we can not change Mr. Ford's proposition, and unless he changes that I, myself, hardly see how we can make good on what he demands of the Government in regard to Gorgas.

Senator UNDERWOOD. Those are details that I can not go into. Of course, I can not change Mr. Ford's proposition, and you can not change it, but if you lay your proposal before Mr. Ford's representatives, they may change it. I am not going into the details, because I can not speak in details.

I thank you very much.

Senator HEFLIN. Before my colleague leaves, I just want to remark, in connection with what the chairman said, that Mr. Ford would not live a hundred years, that Mr. Ford's organization would carry on the work, and he has stated that his son would succeed him in the work. He is quite a young man.

The CHAIRMAN. His son may not be any better man than I am, and he may, of course, be just as good as his father. It all depends on that. That has not been demonstrated. Maybe that will appear in the hearings.

Senator GOODING. Mr. Chairman, knowing Senator Underwood's spirit of fairness in all matters, and I say that without reservation, because in my short time that I have been in the Senate I know that he has tried to be fair in everything, in all big questions and all other questions, as far as that is concerned, I want to correct him as far as the statement that he makes that up in the Northwest, they can not grow cattle to the extent that they do in the South, and corn and those things. I want so say, Senator, since your boyhood days those great wheat fields up there in Minnesota, and all through the Northwest, have developed into an agricultural country. They grow corn. They have corn up there that matures in 90 days. And they grow clover, and, I think, likely the greatest State in all the Union for clover is Minnesota. In those prime forests up there it is native. It comes in wild when the timber is removed. So that they have those plants that give fertility to the soil to a very large extent up there. I merely wanted to make that correction, because a transformation has taken place since your boyhood days. When you were there you saw only the wheat fields. Cattle are grown in the northern country there to higher perfection than any other place in any of the States in the Union. That is true in Canada, too. They have wonderful grasses up there. The weight of cattle is anywhere from 100 to 200 pounds higher than even the prime steer that comes from the South.

Senator HARRELD. A little fertilizer would help, though?

Senator GOODING. Sure.

Senator UNDERWOOD. The fertility of that soil is being depleted.

Senator GOODING. I agree with you thoroughly. There are two sources. One, of course, is commercial fertilizer, and the other is from the live stock, and I want to develop and encourage the live-stock production. I agree with you that civilization itself depends upon the fertility of the soil. It is the history of the world that when soil fertility has gone backward civilization has gone backward with it. When Rome fell and went down its soil was only producing 4 bushels of wheat to the acre. That is what has happened to every country. It is a matter of history, as far as that is concerned, on which I think we all agree.

The CHAIRMAN. Colonel Barden, we will be glad to hear from you.

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STATEMENT OF W. J. BARDEN, COLONEL, UNITED STATES ARMY, CORPS OF ENGINEERS, STATIONED AT FLORENCE, ALA.

The CHAIRMAN. I want to ask you first, Colonel, your position, for the record.

Colonel BARDEN. My name is Col. W. J. Barden, Corps or Engineers. I am in charge of the Engineer district at Florence, Ala., which district was created for the purpose of construction of Dam No. 2, or the Wilson Dam.

The CHAIRMAN. Have you been in charge from that time on?

Colonel BARDEN. No, sir; I have been there since September, 1920.

The CHAIRMAN. Who preceded you?

Colonel BARDEN. Col. Lytle Brown.

The CHAIRMAN. Where is he?

Colonel BARDEN. He is now at Fort Leavenworth.

The CHAIRMAN. Have you been there since the beginning of the work on the dam?

Colonel BARDEN. No, sir.

The CHAIRMAN. You took it when he left?

Colonel BARDEN. When he left; yes, sir.

The CHAIRMAN. You were not connected with it up to that time?

Colonel BARDEN. No, sir; that was my first connection—in September, 1920.

Senator HARRELD. Are you and he the only ones who have had charge of the work since it began?

Colonel BARDEN. No, sir. When the work was ordered started in the early part of 1918, Col. H. L. Cooper, who at that time had a commission in the Army, but who is now a consulting engineer in the city of New York, was sent down to start the work, and he was there for a short time. The work was suspended shortly thereafter on account of the fact that those who had charge of the priority of supplies of various kinds decided that the materials that would enter into the construction of the dam were more needed for other purposes, and the construction of the dam was suspended until some time in the fall.

The CHAIRMAN. What year?

Colonel BARDEN. Of 1918. After the armistice; then it started up again that winter.

Senator HARRELD. Under whom?

Colonel BARDEN. It was started up again under Maj. D. A. Watt, who was also a temporary officer. Major Watt was succeeded by Col. J. B. Cavanaugh May 1, 1919, and the latter by Col. Lytle Brown in July of that year. Colonel Brown remained in charge until September of 1920.

At the risk of some repetition of what I may have said to the members of the committee when they were down there——

The CHAIRMAN. Let me suggest to you now that you forget that you addressed anybody down there, or that you talked to us, or showed us anything. There are some members of the committee who have not been there, and we want your testimony for the record as much as anything else, so anybody can read it. So talk to us just as though we never had been there.

Senator HEFLIN. Explain it just like you did down there.

The CHAIRMAN. Yes.

Colonel BARDEN. The Holston River rises in southwestern Virginia and the the French Broad in western North Carolina. These unite 4½ miles above Knoxville to form the Tennessee. The latter flows southwest across the eastern part of the State of Tennessee into northern Alabama, thence generally westwardly to the northeast corner of the State where for a short distance it forms the boundary between Mississippi and Alabama, and thence north across Tennessee and Kentucky to the Ohio at Paducah, about 44 miles from where the latter empties into the Mississippi.

The total length of the Tennessee is 652 miles. It is 184 miles from Knoxville to Chattanooga, 208 miles from Chattanooga to Florence, and 256.5 miles from Florence to Paducah.

The total drainage area is 40,570 square miles and the low-water discharge at the mouth is about the same as that of the Ohio at that point.

The Holston River is not navigable for any considerable distance, but the French Broad River is for a distance of about 70 miles to Leadvale, Tenn. The Tennessee River in its original condition was navigable throughout the year from its source to Chattanooga for light-draft traffic. From Chattanooga to Hales Bar, 33 miles, where the river breaks through the mountains, the slope was steep and the current swift but light-craft navigation was possible, with some difficulty, throughout the greater part of the year. From Hales Bar to Browns

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Island, or the Muscle Shoals section, the slope was moderate, but the river was obstructed by gravel and rock bars. Light-draft navigation was, however, possible throughout the greater part of the year over the whole of this section of 138 miles. The Muscle Shoals section extends from the head of Browns Island to Florence, a distance of about 37 miles. This consists of a series of rock shoals with steep slopes, and very swift current and formed a complete barrier to upstream navigation at all times and to downstream traffic except at high stages, and then only at great hazard. Between Florence and Riverton, 30 miles, there were two serious obstructions, Colbert and Bee Tree Shoals, which formed a complete barrier to navigation at low-water stages, but the entire section was navigable for traffic in both directions at medium high stages.

From Riverton to the mouth there were gravel bars and a rock bar at Big Bend Shoals, but the river was navigable throughout the entire length of this section, 227 miles, except at low-water stages.

The river has been under improvement for many years. Above Chattanooga the project provides for a 3-foot depth except for a lock and dam at Caney Creek, about 96 miles above Chattanooga, which will provide a 6-foot depth for about 25 miles. The project for this section of the river is not completed, but the 3 feet is available for about six months of the year and somewhat less for the remainder of the year.

Below Chattanooga a dam for power and navigation purposes has been constructed at Hales Bar, 33 miles below Chattanooga. The gates, valves, and operating machinery of the lock were provided by the United States, but all the rest of this work was constructed and paid for by private interests (Chattanooga & Tennessee River Power Co.).

Senator NORBECK. I beg your pardon. What proportion, about, did the Government pay of the full cost?

Colonel BARDEN. The cost to the United States is given as $236,388 and the cost to the company at $6,686,700, exclusive of the power-house superstructure and installation, which would be a great deal more.

Mr. WILLIAMS. I believe the total cost, Colonel, is $11,000,000.

Colonel BARDEN. Yes.

This dam gives 6-foot navigation to Chattanooga (lock 60 by 267 feet). The lift at low water is 37½ feet.

The CHAIRMAN. That lock is not big enough to take a vessel through as large as the proposed lock at Wilson Dam, if you utilize the entire lock at Wilson Dam, is it?

Colonel BARDEN. It is the same width but not quite so long.

Senator HEFLIN. The same size vessel will go through, then?

The CHAIRMAN. No; it can't go through.

Colonel BARDEN. The length is less.

The CHAIRMAN. The proposed lock at Wilson Dam is 300 feet?

Colonel BARDEN. Yes.

The CHAIRMAN. This lock at this present dam is 267 feet?

Colonel BARDEN. That is it.

The CHAIRMAN. Can you tell us, Colonel, how much power is developed at this dam you are speaking of, owned by private parties, and what it is used for?

Colonel BARDEN. I think the installed capacity is about 45,000 horsepower. The power is all sold, or practically all, to the Tennessee Power Co., which supplies power to Chattanooga, Nashville, and other portions of the State of Tennessee.

Senator NORBECK. How far is it from Nashville to this power plant?

Colonel BARDEN. I think it is about 100 miles. That development at Hales Bar is only one of the sources of power of the Tennessee Power Co.

Senator HEFLIN. Will this lock and dam at Chattanooga be sufficient to carry vessels up the river?

Colonel BARDEN. I think so; yes, sir. It might not be possible to take as many boats through at a time.

Senator HEFLIN. But it will take through any vessel that will be used on that river for navigation purposes?

Colonel BARDEN. I think so.

The CHAIRMAN. There are Government vessels there on that river now that run through the locks 300 feet long that could not go through this lock. The party visiting down there rode on the vessel up to the Gorgas steam plant on the Warrior River, and that was only one of quite a lot of vessels that are navigat-

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ing that river and run from there way down to New Orleans, as a matter of fact. They are 300 feet long.

Senator HEFLIN. That vessel was not 300 feet long.

The CHAIRMAN. That vessel was 300 feet long that we were on, Senator.

Colonel BARDEN. I may be mistaken about that.

The CHAIRMAN. As a rule, I think 264 feet would take everything through there. In fact, you could not use any vessel longer than 264 feet if you had any one lock in your system that was only that long.

Colonel BARDEN. I will say this, though, that it is comparatively easy and inexpensive to increase the length of a lock, whereas to increase its width would be very difficult.

Senator HARRELD. You could increase the length so that they could carry vessels as long as the one at Muscle Shoals?

Colonel BARDEN. That is right; yes, sir.

From Hales Bar to the Muscle Shoals section the existing project calls for two low dams with locks 60 feet by 265 feet, or the same size as those at Hales Bar.

The CHAIRMAN. Those are locks independent of this Muscle Shoals improvement of which we are speaking now?

Colonel BARDEN. Yes, sir. One of them is at Widows Bar and the other at Bellefonte Island. The lift in each case is from 8 to 9 feet.

The CHAIRMAN. No power?

Colonel BARDEN. No power. It will extend the 6-foot navigation from Hales Bar down to Bellefonte Island, 39 miles. Construction work on the Widows Bar lock has been started, but preliminary work only has been done at Bellefonte Three additional locks and dams between Bellefonte and the Muscle Shoals section have been recommended to secure 6-foot navigation, but they have not been authorized, and the project calls for open-channel work only to secure a 5-foot channel. The actual condition is that a 3 to 4 foot draft is available for about six months, with lesser depths for the remainder of the year. It is quite possible that instead of these five low dams two higher dams might be used, at which power could be developed. A new survey of the river is now being made by the district officer at Chattanooga, and undoubtedly any further action by Congress would await his report.

Skipping for the moment the Muscle Shoals section, from Florence to the mouth the project calls for a channel 6 feet deep at ordinary low water, and 5 feet deep at extreme low water, to be secured by open-channel methods, except at Colbert and Bee Tree Shoals, where a lateral canal 8 miles long with one lock is provided. The lock is 80 by 287 feet, with 6 to 7 feet on the miter sills. The canal is completed and the open-channel work about 80 per cent finished. Four-foot navigation is usually available from Florence to the mouth throughout the year, and 6 foot for about eight months.

Muscle Shoals section: The shoals in this section (Elk River, Big Muscle, and Little Muscle) are caused by hard flinty rock strata which have caused the river to widen out in places to nearly 2 miles. The total fall in the 37 miles is 134 feet. As already stated, upstream navigation was never possible. Downstream navigation was occasionally attempted by rafts and light vessels, but always with great risk.

Efforts were made at an early date to pass boats safely around the obstructions by a canal with locks, and by the act of Congress of May 23, 1828, a grant was made to the State of Alabama of 400,000 acres of the public land to be sold and the proceeds applied to that purpose. Work was begun by the State on the Big Muscle Shoals section in 1831. This canal was 60 feet wide and 6 feet deep, with locks 32 feet wide, 120 feet long, and 5 feet lift. It was opened to navigation about 1836, but the obstructions in the river above and below limited navigation to certain stages of the water. It appears to have been used for a short time only, after which, no funds being appropriated for its maintenance, it soon fell into decay.

In 1875 work was commenced on the present canal, which consists of two sections, one on the north bank, 14¼ miles long, with a lift of 85 feet in nine locks, overcoming Big Muscle Shoals, and one on the south bank, 2½ miles long, with a lift of 17 feet in two locks, at the Elk River Shoals. The two sections are 8 miles apart. The work was completed in 1890, at a total cost of $3,191,726.50. The original project called for another section of canal to overcome Little Muscle Shoals and carry the improvement to Florence, but this was changed to provide for open-channel work.

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The canal proper gives 5 feet navigation, but, owing to deficient depth in the river between the two sections and below the lower section to Florence, the minimum available depth throughout the year is less than 2 feet; 3 feet is available about six months and 4 and 5 feet for shorter periods. Navigation is now entirely blocked by the Wilson Dam.

Commerce: The commerce on the river above Chattanooga for the last five years was reported as follows:

	Tons.	Passengers.
1916	345,604	2,240
1917	613,243	592
1918	529,299	70
1919	589,660	634
1920	581,055	1,855

From Chattanooga to Riverton (except Muscle Shoals section).

	Tons.	Passengers.
1916	208,443	10,169
1917	170,968	27,193
1918	141,486	22,173
1919	164,250	19,215
1920	185,242	20,434

This includes car ferry service moving 22 miles on the river, Guntersville to Hobbs Island.

Through Muscle Shoals Canal it was very small.

	Tons.	Passengers.
1916	10,439	60
1917	8,677	18
1918	5,982	0
1919	8,225	0
1920	8,127	0

Below Riverton:

	Tons boated.	Tons rafted.	Passengers.
1916	328,989	74,589	23,228
1917	380,175	36,129	15,566
1918	239,241	41,361	5,590
1919	237,886	5,873	5,728
1920	183,601	41,584	3,394

Development for power and navigation: The question of the development of this section for the combined purposes of power and navigation has been under consideration for many years and has been the subject of numerous investigations and reports both by private interests and the Engineer Department under instructions from Congress. The first official investigation was in accordance with the provision in the rivers and harbors act of March 2, 1907, that "the Secretary of War may appoint a board of engineers whose duty it shall be to examine the present condition of the United States Canal and the Tennessee River from the head of Elk River Shoals to the Florence railroad bridge * * * with a view to permitting the improvement of the above-described stretch of said river by private or corporate agency in conjunction with the development of water power by means of not more than three locks and dams; and the said board may examine any plans presented by such agency

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and shall report whether the same, if constructed, can, without injury to navigation, or with advantage thereto, be used to develop water power, and what portion, if any, of the expense of the work should be borne by the United States." The width of the river made very long and consequently expensive dams necessary, so that private interests were apparently unable to finance the entire work nor even such portions of it as were necessary to meet what the Engineer Department felt it could recommend as a proper expenditure for navigation.

The matter seemed, however, in a fair way for settlement about the time of the passage of the national defense act, in 1916. An offer had been received from the Muscle Shoals Hydroelectric Power Co. in 1913, in accordance with advertisements issued under instructions of the Committee on Rivers and Harbors, House of Representatives. A favorable report had been made on this proposition by the Engineer Department in 1914, which was published in Committee Document No. 20, House of Representatives, Sixty-third Congress, second session. This report, however, suggested additional borings and these were made and a further report submitted as directed by the rivers and harbors act of 1915. This report was made in March, 1916, and published in House Document 1262, Sixty-fourth Congress, first session.

The project embraced a lock and low dam (No. 1) just above the Florence Bridge for navigation only and two high dams (Nos. 2 and 3) with locks for navigation and power.

The total cost of the locks, dams, and power-house substructures was estimated at (p. 35) $19,000,000, and of the power-house superstructures and hydroelectric equipment, which was to be paid for entirely by the company, at (p. 164) $15,327,000; total, $34,327,000.

NOTE.—The present estimates for the complete work are, lock and dam No. 1, $1,400,000; No. 2, $45,500,000; No. 3, $25,000,000; or a total of $71,900,000, which, in view of increased costs since the date of the original estimate compares favorably therewith.

The company was to contribute $3,000,000 in cash toward the cost of the first item and to make certain stated annual payments sufficient to amortize at 3 per cent in 100 years the sum of $7,128,000, which left as the cost to the United States for the combined works, $8,872,000. This latter figure was approximaely that which had been determined by the Board of Engineers which had investigated the matter as representing the value of the improvement to navigation. Reference is made to House of Representatives, Committee on Rivers and Harbors, Document No. 20, Sixty-third Congress, second session. It was approximately the cost of extending the navigation from the lower end of the present canal down to Florence and from the upper end of the canal to Flint River, this section being that which would be covered by the combined power and navigation scheme—about 80 miles. But this would have provided for a 5-foot depth only as against the 6-foot depth and much better channel that would be offered by the power dams.

The Company was also to pay to the United States, after a certain amount of installation had been completed, 35 cents per horsepower per year of installed capacity (p. 41). This amount the district engineer, Major Burgess (p. 37), estimated would amortize something between $1,778,000 and $5,500,000, thus further decreasing the ultimate cost to the United States so that the total would be beween $3,350,000 and $7,100,000.

In forwarding the report the Board of Engineers for Rivers and Harbors concurred with the favorable report of the district engineer, but suggested, in view of the provisions of section 124 of the national defense act, which was then pending, that action be suspended as it might be decided that this Muscle Shoals power should be utilized by the United States for a nitrate plant. The Chief of Engineers concurred in this recommendation.

Subsequent developments are now quite generally known. The national defense act was passed with the $20,000,000 item for a nitrate plant. A commission or commissions were appointed to investigate the subject, but no definite action was taken until this country entered the war. Nitrate plant No. 1 was then established at Sheffield, and later No. 2. It is understood that no money from the national defense act was used on No. 2, all the expenditures there and most of those at No. 1 having come from war appropriations. The construction of this dam—No. 2, or Wilson Dam—was ordered by the President on February 23, 1918, under the authority contained in this provision of the national defense act, presumably to furnish cheaper power for nitrate plant

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No. 2. All the money spent here is from that fund. We have had a total allotment of $17,159,610.42, of which $16,890,507.46 has been expended or obligated, leaving an available balance on April 1 of $269,102.96.

The CHAIRMAN. Have you reached a point, Colonel, where you have just gotten up to what we are considering here?

Colonel BARDEN. Yes, sir. I will now describe what has been done.

The CHAIRMAN. It is now nearly 12 o'clock, and probably we had better stop at this point. Your testimony to-morrow will commence where you left off, and will be a consideration of the Wilson Dam, as I understand.

Colonel BARDEN. Yes.

(Whereupon at 11.55 o'clock p. m. the committee adjourned to 10.30 o'clock a. m. to-morrow, Tuesday, April 11, 1922.)

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MUSCLE SHOALS.

TUESDAY, APRIL 11, 1922.

UNITED STATES SENATE,
COMMITTEE ON AGRICULTURE AND FORESTRY,
Washington, D. C.

The committee met, pursuant to adjournment, at 10.30 o'clock a. m., in Room 224, Senate Office Building, Senator George W. Norris (chairman) presiding.

Present: Senators Norris, McKinley, McNary, Capper, Keyes, Gooding, Norbeck, Harreld, Harrison, Heflin, and Caraway.

The CHAIRMAN. The committee will come to order, and Colonel Barden will proceed with his testimony.

STATEMENT OF W. J. BARDEN, COLONEL, UNITED STATES ARMY—Resumed.

The CHAIRMAN. Colonel, when we adjourned you had just reached the point where you were going to take up this Wilson Dam, had you not?

Colonel BARDEN. Yes, sir; the dam is divided into three parts: The lock on the right bank of the river; the spillway dam, whic occupies the northerly three-fourths of the river bed; and the power house, which continues the dam to the left or south bank of the river. All these parts are spanned by a highway bridge. Jacksons Island separates the river into two channels at the site of this work.

The total length, bank to bank, is approximately 4,500 feet. The dam section is 2,890 feet long, and the power house 1,184 feet, the remaining distance being taken up by the lock and abutment connections. That is shown in that diagram up there [indicating].

There are two locks in tandem; that is, one below the other; each 300 feet long by 60 feet wide, with 7½ feet on the miter sills, and a lift of 45½ feet, or a total of 91 feet for both.

The upper lock will be spanned at its upper end by a bascule bridge, carrying the highway across it from the north bank to the concerete-arch bridge, which spans the remainder of the entire structure. The dam is composed of two sections, the nonoverflow and the overflow or spillway sect'on. The former, adjacent to the lock, is only 180 feet long, extending to the original bluff line, where it connects with the spillway section. Both sections are nonreinforced gravity structures, surmounted, as already stated, by a concrete-arch bridge. The spillway section provides for the regulated discharge of excess water over the crest by means of 63 controlling gates, in order to maintain the pool above the dam at a fixed elevation of 501 feet. The pool extends upstream to the s'te of the proposed Dam No. 3, 14.7 miles, and will have a surface area of 14,037 acres. These crest gates are 38 feet wide by 18 feet high. The total height from the river bed to the top of the gates or pool elevation is 97 feet. The roadway is some 20 feet higher. The foundations extend 15 to 16 feet into the bedrock. The width of the dam at the bedrock is 101 feet, and the apron 59 feet wide, making a total width of 160 feet. The maximum head of water on the turbines will be 96 feet and the minimum 68 feet.

The power-house section is a continuation of the dam, with a slightly different cross section, with a building on the lower side to house the machinery. The arch bridge and roadway are also carried across it. It is pierced by three penstocks for each generating set, each about 12 by 16 feet in size, which carry the water to the turbines. That [indicating] is a cross section of the generating sets. The electrical transformer and distributing apparatus will be located on the bluff overlooking the power house. A railway will be built, terminating

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beneath the cranes of the power house, and an ice and trash fender will extend from the north end of the power house to the south bank of the river.

The turbines are 30,000 horsepower. The generators are 25,000 kilowatts, 12,000 voltage. The total weight of the rotating parts is nearly one-half million pounds.

As preliminary to actual construction work, a camp had to be constructed and plant assembled and erected. The number of camp buildings is over 500, there being 30 permanent houses. There are about 5 miles of sewer, 6 miles of water main, 7 miles of road, 28 miles of railroad track of a permanent nature, standard gauge, connecting with the Southern Road at Sheffield through nitrate plant No. 2 and with the Louisville & Nashville Road at East Florence.

There are three mixing plants, one on the north side, one on Jacksons Island, and one on the south side; a crushing plant on Jacksons Island; and a quarry on the north bank of the river a short distance above the dam. There are machine shops, warehouses, etc., sufficient for all needs. The sand and gravel is secured from the bed of the river about 8 miles below Florence by hydraulic dredges. It is washed and screened at the site where dredged and carried to an unloading dock just below the Florence Bridge, where it is unloaded into bins and thence discharged into cars and carried to the site of the work.

The work as a whole is about one-third completed. There will be, when completed, a million and a quarter yards of concrete——

Senator GOODING (interposing). Now, are you discussing all the dams?

Colonel BARDEN. There is only one dam on which work has started, Senator; that is Dam No. 2.

The CHAIRMAN. Before you came in, Senator Gooding, he had started on a discussion of what is known as the Wilson Dam, or, technically speaking, Dam No. 2, and that is the only one he has anything to say about just now.

Senator GOODING. You say that a third of that is completed—that one dam, and not the whole works?

Colonel BARDEN. Yes, sir; a third of this one dam.

Senator GOODING. I just wanted to get that clear.

Colonel BARDEN. Yes, sir. No work has been started on either of the others.

Senator CAPPER. Has the War Department estimated the cost of completing that dam?

Colonel BARDEN. Yes, sir. I am going to go into that a little later.

We have already placed 263,000 yards of concrete, leaving slightly less than a million yet to be placed. There will be a total of 620,000 yards of rock excavation, of which 255,000 yards, or 41 per cent, have already been completed.

Of the 4,000 feet of foundation in the river bed about 2,700 feet has already been completed.

The committee will understand, of course, that the foundation work is really the most difficult part of the structure.

The CHAIRMAN. That is below the water?

Colonel BARDEN. Yes, sir. Cofferdams have to be built and the water pumped out and work done in the dry.

The CHAIRMAN. Wherever you put in this concrete below the surface of the water you have had to absolutely do dry work?

Colonel BARDEN. Yes, sir.

The CHAIRMAN. You surrounded it with cofferdams?

Colonel BARDEN. We surrounded it with cofferdams and pumped the water out.

Senator GOODING. Your borings all showed that the rock here is continuous, of course?

Colonel BARDEN. Oh, yes.

Senator GOODING. To what depth did your borings go?

Colonel BARDEN. They were made in 1916. They went to 100 feet depth. The river bed is solid rock.

Senator GOODING. Yes; that is my understanding; and that thickness is sufficient, of course?

Colonel BARDEN. The thickness is indefinite.

Senator GOODING. Indefinite?

Colonel BARDEN. Yes.

The CHAIRMAN. At some time, Colonel—I don't want to interfere with any order that you have in your mind—I want you to tell the committee before you finish the condition that is there now and just what you had to do in letting the water in where you had already pumped out the cofferdams, and what delay there has been there.

Colonel BARDEN. Yes, sir; I will take that up later.

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The CHAIRMAN. All right.

Colonel BARDEN. I would like to make a little statement about available power, because there have been some published statements concerning it which I think have, perhaps, been somewhat misleading.

We have available daily gauge readings at Florence from November 7, 1871, to the present time, or for a period of over 50 years. Discharge measurements have been taken at intervals for a number of years, and a rating curve established giving the flow at all stages. The horsepower available depends on the fall or head at the dam and the discharge.

The gauge readings have been very accurately tabulated and a power curve determined showing the amount available at all stages, and the percentage of time, based upon the 50-year record, that any particular amount will be available.

Primary power is that available every day in the year, namely, that resulting from the minimum flow of the river. Secondary power is that aavilable a portion of the time only, varying, of course, from small to large amounts as the river rises and the flow increases.

We have taken as the primary power at Dam No. 2, 87,300 horsepower. This amount has been available for 99.4 per cent of the time for 50 years. In other words, there were 101 days in that period when a less amount was available. It is not, then, the absolute minimum, but is believed to be very conservative; 100,000 horsepower, which has often been spoken of as the primary power, would be available a little more than 97 per cent of the time.

In this connection I noted in reading the regulations of the Federal Power Commission, established by the Federal water power act of 1920——

Senator MCNARY (interposing). What would be the horsepower available 100 per cent of the time.

The CHAIRMAN. Practically 87,300.

Colonel BARDEN. That is 99.4 per cent of the time.

Senator MCNARY. That shows a little hiatus.

The CHAIRMAN. A little; yes.

Colonel BARDEN. At the lowest gauge readings of which there are any accurate records, minus 0.8 on the Florence gauge, the power would be 71,800. There was a period in 1904 when the gauge readings were inaccurate, and we can not say what was the absolute minimum then—that was a very low period. It is possible that the flow might have been somewhat less at that time, but we are not able to state.

Senator GOODING. 1884, did you say. What year?

Colonel BARDEN. 1904.

Senator MCNARY. What is the maximum primary power at Dam No. 2, according to the readings, which have been covered 10 years?

Colonel BARDEN. Well, there is no maximum primary. The primary power is always a minimum. That is, you can only have that at extreme low water.

Senator MCNARY. I understand that thoroughly, from a technical standpoint, but what is the highest maximum power that you have at flood tide that you could develop at Dam. No. 2, known as the Wilson Dam?

Colonel BARDEN. The maximum installation that is contemplated is 624,000 horsepower.

The CHAIRMAN. That is your installation, Colonel. It would be more than that, as a matter of fact, if you installed more machinery, would it not?

Colonel BARDEN. Oh, yes.

Senator GOODING. My understanding of the matter is that there will be no flood; that is, you are going to control the flood?

Colonel BARDEN. No, sir; there is no provision for flood control.

Senator GOODING. Is there not? I thought some of these dams would act as reservoirs in order to control the flood?

Colonel BARDEN. Not these dams that are included in this project, Senator.

Senator MCNARY. Nothing in the Ford offer contemplates impounding water, nothing to prevent the flow of the water of the Tennessee River around Muscle Shoals?

Colonel BARDEN. As I understand it there is nothing in the offer itself.

The CHAIRMAN. There is nothing in any of the offers.

Senator GOODING. That subject has been discussed, however.

The CHAIRMAN. That is included in the bill that I introduced yesterday.

Senator MCNARY. That is the chairman's idea.

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The CHAIRMAN. As a matter of fact, it has been discussed a great deal. When the colonel gets through with his description of Dam No. 2 I want to ask him about it if he knows anything about it.

Senator MCNARY. I would like to know the maximum horsepower at the high stage of water.

Colonel BARDEN. We have carried our table only down to 1,106,000 horsepower. That is available about 7 per cent of the time.

Senator MCNARY. That is, with this whole power in use at one period?

Colonel BARDEN. The river would be discharging 139,300 cubic feet a second, which is not an unusual discharge.

The CHAIRMAN. That is a million and what?

Colonel BARDEN. One million one hundred and six thousand horsepower.

The CHAIRMAN. That, of course, would be available so short a time in the year that it is practically useless?

Colonel BARDEN. Yes, sir; it is not commercially feasible.

The CHAIRMAN. There is only one way to make that practicable, and that is to equalize the flow of the river?

Colonel BARDEN. Yes, sir; and equalizing the flow of the river, of course, would not give as great a power as that at any one time.

The CHAIRMAN. No; I understand that. It would take it off at some place and put it on at a lower place?

Colonel BARDEN. Yes, sir; it would give a larger minimum or primary power.

Senator GOODING. I suppose the load in the South would be somewhat equally distributed over the entire year?

Colonel BARDEN. Yes, sir.

Senator GOODING. In some of the northern States when we get to using electricity for heat we can use a heavier load in the wintertime than in the summer time; but that would not be true of the South, would it?

Colonel BARDEN. I hardly think so.

Senator GOODING. Your load would be even throughout the whole year?

Colonel BARDEN. I think so.

Senator HARRISON. I understood that Mr. Mayo had discussed that the other day and said that the people of Chattanooga were going to cooperate, and that it was in the Ford plan, although it was not in the proposal.

The CHAIRMAN. That may be. There are a great many things in the plans or in the idea of Ford that he is going to do that are not in his offer.

Senator GOODING. What I understand is that there will be an improvement of navigation on the Tennessee. Of course there is a tremendous amount of water that increases the flow of the Tennessee River to a great extent for a certain length of time.

Senator HEFLIN. The completion of the Wilson Dam and Dam No. 2 makes the river navigable all this way?

Senator GOODING. Yes; I understand that, but even so, I understand the water is so low in some places that you can not navigate it all during the dry season.

Colonel BARDEN. Any increase of the low-water flow of the river which would be secured by the construction and operation of reservoirs would be beneficial both to navigation and power.

Senator GOODING. It would increase the power?

Colonel BARDEN. Yes, sir.

Senator GOODING. You do not propose, then, to do this in what you are discussing?

Colonel BARDEN. No, sir.

Senator GOODING. I just wanted to be clear on that.

Colonel BARDEN. At this Dam No. 2 we will have for 83.3 per cent of the time, or about 10 months of each year, 141,000 horsepower; for about 8 months of the year we will have 205,000 horsepower; for about 6 months, 306,500 horsepower; and 600,000 horsepower for about 20 per cent of the time, or about 2½ months.

For Dam No. 3, which is the power dam above this, which is proposed but not now under construction——

Senator MCNARY. Before you get to that let me ask you something, Colonel, about this secondary power. To what use do you propose to put the secondary horsepower?

Colonel BARDEN. The secondary power has a certain market value. It is nowhere near that of the primary. What use would be made of this particular secondary power would depend on the policy with reference to the nitrate plant.

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Senator McNARY. It would not have any particular commercial use, would it?

Colonel BARDEN. Two of the southern power companies list in their published rates a price for secondary or dump power. That for the Georgia Railway & Power Co., approved by the Railroad Commission of Georgia on September 22, 1920, reads as follows:

"By secondary or dump power is meant the power which the company may be able to deliver in excess of the power required, reserved, sold, or supplied as primary power, and the company reserves to itself the right to shut off or discontinue or to resume the delivery of said secondary power at its option."

The rate is 9.9 mills per kilowatt hour. That is a pretty high rate.

Senator GOODING. What is the primary rate?

Colonel BARDEN. Primary rates run from 14.4 mills down to 6 mills for what is known as the energy charge, in addition to which there is a demand charge based on the amount of power that is used.

The Southern Power Co. has a dump power rate to consumers of 6 mills per kilowatt-hour. I am unable to tell the committee how much power is sold at those rates.

Senator McNARY. I can not see that it would have any particular value outside of the operation of machinery to make ammonium nitrates, and that is limited by the fact that the individual owner or the Government would not want to install a machine that it could operate only sporadically during the year.

Colonel BARDEN. Senator, I think its value is largely for manufacturers and others who have steam plants available, but where they can use the water power for a portion of the year when the power companies can deliver it to them, and for the remainder of the year they run their steam plants, and thereby effect an economy, perhaps, for the entire year.

Senator McNARY. That is an economy in the fuel used?

Colonel BARDEN. Yes, sir.

Senator McNARY. It is contemplated to develop down there a certain quantity of power which will be furnished to cities for lighting purposes, energy for industrial purposes, and during high-water periods for the manufacture of ammonium nitrate, and there is some power that really has not any commercial utility, and lumping it altogether it will have a fair value. I can see, and I wondered if you had worked into that problem sufficiently to say just what use you would make of it.

The CHAIRMAN. Of course, the secondary power, as I understand it, depends a great deal, as far as value is concerned, upon the portion of the year for which it can be used?

Colonel BARDEN. Yes.

The CHAIRMAN. If you have a secondary power that can be used for 10 months, it has much more value than if it can only be used for three months.

Colonel BARDEN. Yes, sir.

The CHAIRMAN. You could afford to use, perhaps, your secondary power that is good for 10 months and maintain a steam plant for the other two to keep it up.

Colonel BARDEN. Yes, sir.

The CHAIRMAN. Whereas if you could only use your secondary power three months, it might be that it would not be possible, as a financial proposition, to maintain your steam plant for the balance of the year?

Colonel BARDEN. Yes, sir; that is correct.

Senator GOODING. But if there is so much power that can be developed you would not want to develop it in a steam plant. Is not that so generally throughout the country, if we are going to talk about the general development of our electric energy?

Colonel BARDEN. I don't know that I quite understand you, Senator.

Senator GOODING. What I mean to say is this: An auxiliary steam plant is not necessary, or won't be in connection with this project when it is completed at all in any sense, will it?

Colonel BARDEN. I think, Senator, if this dam were completed and the power were to be marketed commercially, it would to a certain extent replace steam power which is now in use.

Senator GOODING. Yes; I understand that. The point I am making is that an auxiliary plant would not be in the least economical for this short period of time that it would be required. You had better develop what you can there that will give 100 per cent of power the year around.

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Colonel BARDEN. The point I think you are making is what I was going to bring out a little later, that it would not be economical at the present time to put in the entire installation for which the ultimate plans are made.

Senator GOODING. Yes; but lay the foundation for the greater development later.

Colonel BARDEN. Yes, sir. For Dam No. 3 the corresponding figures would be 34,000 primary horsepower; 55,500 horsepower 10 months—that is, secondary horsepower—81,000 secondary horsepower for 8 months; 122,500 secondary horsepower for 6 months; and 250,000 horsepower for about 2½ months. The total primary power at the two dams is, then, 121,300. The steam plants at Gorgas and No. 2 have a combined capacity of 90,000 kilowatts, or approximately 120,000 horsepower. So that if Dams No. 2 and No. 3 were built and both the steam plants now owned by the Government were used, we would have a total of 241,300 primary horsepower.

The CHAIRMAN. Well, now, what proportion of the year would that contemplate using the steam plants? The entire year?

Colonel BARDEN. Oh, no, sir. They would be used probably not to exceed three months of the year. They would have to be in stand-by condition the remainder of the time.

The CHAIRMAN. Without the steam plants at all, what would be the combined primary power?

Colonel BARDEN. One hundred and twenty-one thousand three hundred.

The CHAIRMAN. One hundred and twenty-one thousand three hundred horsepower?

Colonel BARDEN. Yes, sir; and the horsepower of the steam plants is about equal to it.

The CHAIRMAN. Yes. Well, that is including Gorgas?

Colonel BARDEN. Yes, sir.

The CHAIRMAN. I think it would be well, if you can, as you proceed, to give us the figures excluding Gorgas, because that is a possibility that may arise, that we will have to exclude it.

Colonel BARDEN. Yes, sir; I have that for you. The value of the secondary power is naturally much less than that of primary, since it can not be depended upon either as to time or amount. I submit here a table showing somewhat more in detail these figures that I have given you.

(The table referred to is as follows:)

Probable power output, Muscle Shoals, Ala., based on 49-year stream-flow record.

Class of power.	Horsepower.	Kilowatts.	Kilowatt-hours per year.		
			100 per cent.	80 per cent.	60 per cent.
WILSON DAM.					
Primary	87,300	65,100	570,269,800	456,215,800	341,161,900
10 to 12 months	53,700	40,044	325,092,600	260,074,100	195,055,600
8 units [1]	100,000	74,570	420,600,400	336,480,300	252,360,200
6 to 10 months	165,500	123,413	654,375,000	523,500,000	392,625,000
4 to 6 months	131,500	98,060	353,362,800	282,690,200	212,017,700
Total	438,000	326,617	1,903,100,200	1,522,480,100	1,141,860,200
DAM NO. 3.					
Primary	34,000	25,385	222,372,000	177,897,800	133,423,400
10 to 12 months	21,500	16,001	129,891,000	103,913,100	77,934,800
6 to 10 months	67,000	49,962	280,969,000	224,774,900	168,581,200
4 to 6 months	57,000	42,505	153,615,000	122,891,900	92,168,900
Total	179,500	133,853	786,847,000	629,477,700	472,108,300
TOTAL.					
Primary	121,300	90,485	792,641,800	634,113,600	475,585,300
10 to 12 months	75,200	56,045	454,983,600	363,987,200	272,990,400
6 to 10 months	232,500	173,375	935,344,000	748,274,900	561,206,200
4 to 6 months	188,500	140,565	506,977,800	405,512,100	304,186,600
Total	617,500	460,470	2,689,947,200	2,151,957,800	1,613,968,500

[1] Limit.

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Colonel BARDEN. If all the steam power were used in connection with Dam No. 2 to convert secondary power into primary we would have 87,300 plus 120,000, or a total of 207,300 horsepower. Now, if we only used steam plant No. 2, which has a capacity of about 80,000 horsepower, we would have a total primary of 87,300 hydro plus 80,000 steam, or 167,300.

The CHAIRMAN. That is with the steam and Dam No. 2?

Colonel BARDEN. Yes, sir.

The CHAIRMAN. Now, if you would add to that Dam No. 3, what would you have?

Colonel BARDEN. We would have 34,000 more, or a total of 201,300 horsepower.

The installations of hydroelectric machinery are usually made slowly, as the market develops and the load is built up. In this instance it does not appear advisable to install more than about eight units at present, and probably the four units already purchased should be installed and tried out before additional contracts are made. I might say to the committee that four units have already been purchased and are largely completed. Portions of them are already on the ground.

Senator MCKINLEY. Is it not a fact that $1,000,000 out of $1,300,000 has been already spent?

Colonel BARDEN. Practically that: yes, sir; $1,000,000 out of $1,300,000?

Senator MCKINLEY. Yes, sir.

Colonel BARDEN. The development of water turbines is progressing rapidly, and it is quite possible that still more powerful and efficient machines would be available in a very few years.

Senator MCKINLEY. Would it not be well to bring in there that these four units amount to 120,000 horsepower?

Colonel BARDEN. Yes, sir.

Senator MCKINLEY. These four machines?

Colonel BARDEN. These four machines already purchased would develop 120,000 horsepower, which is more than the primary.

Tailrace excavation, draft tubes, and power-house substructure would be completed for the total ultimate installation in all 18 units.

Our estimate of the cost of completing the work on this basis; that is, providing draft tubes, excavation, and power-house substructure for the total number of units, but actually installing at the present time only four units, is $20,849,000, and putting in eight units, $23,177,000.

The four units of 120,000 horsepower installation will develop all primary and a small amount of secondary horsepower, and the eight-unit (240,000 horsepower) plan would include the secondary power down to about seven months.

No storage would be provided at either Dam No. 2 or Dam No. 3. The pools can not be drawn down without reducing the depth required for navigation nor could they be raised without large additional costs for damages to overflowed lands.

Senator MCNARY. What pool do you refer to?

Colonel BARDEN. The pools formed by this Dam No. 2 and Dam No. 3.

It is probable that this will also be true of any additional dams built in the main river for navigation and power.

The district engineer at Chattanooga, however, who is making a comprehensive survey of the Tennessee River and tributaries, states that on these tributaries above the Muscle Shoals section 46 combined reservoir and power dams are believed to be feasible, each having a draw-down capacity varying from 5,000 to 800,000 acre-feet.

Senator MCKINLEY. Those are the ones up here [pointing to a map], are they?

Colonel BARDEN. I don't know whether they are exactly the same ones or not, Senator, but they are approximately the same.

The CHAIRMAN. The figures that the Colonel is giving now are from the Government engineers. The dams illustrated on this map come from the Tennessee River Improvement Association, so they are from different sources, although they cover the same territory to a great extent.

Colonel BARDEN. Yes; and I presume they are practically the same. Major Fiske tells me that his report is not yet ready for submission, and this is merely preliminary information he is giving now. He says there are 46 combined reservoir and power dam sites available, each having a draw-down capacity varying from 5,000 to 800,000 acre-feet. The two largest, with capacities of 700,000 and 800,000 acre-feet, respectively, are located on the Clinch

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River, and he thinks that if their draw down were properly regulated in the interest of the Muscle Shoals dams the minimum flow and therefore the primary power would be about doubled for an average year.

The CHAIRMAN. That is, with those two?

Colonel BARDEN. With those two reservoirs, which are the two largest.

The CHAIRMAN. Has he given an estimate of the cost?

Colonel BARDEN. No, sir. He goes on to say that he believes that those will be feasible, both from a construction standpoint and a financial standpoint, but he has not the complete information available as yet.

The CHAIRMAN. Are they both on the Clinch River, Colonel?

Colonel BARDEN. Yes, sir; both of those.

The CHAIRMAN. How far apart? Do you know?

Colonel BARDEN. No, sir.

The CHAIRMAN. Can you point that out on the map, Mr. Williams?

Mr. WILLIAMS. One, I believe, is here [indicating], and the other is down in here somewhere.

The CHAIRMAN. Above the conjunction with that other river?

Mr. WILLIAMS. Yes, sir. They are both very high dams.

Senator MCNARY. What is the combined acre-feet?

Colonel BARDEN. A million and a half.

The CHAIRMAN. You say that, if properly operated, these two dams would double the primary power at Muscle Shoals?

Co'one BARDEN. In what he calls an average year.

Senator GOODING. Have you any record for any length of time of the flow of these rivers that he speaks of, where these reservoirs are mentioned?

Colonel BARDEN. I don't know about that.

Snator GOODING. You don't know whether they have a gauge record that has been kept in the South or not, by the Government?

Colonel BARDEN. Yes, sir. We have a 50-year record at Florence.

Senator GOODING. You don't know how far up the river they extend?

Colonel BARDEN. I presume they have the records up there that extend over a large number of years.

The CHAIRMAN. Have you ever been up to the proposed site of these two dams?

Colonel BARDEN. No, sir. I can not give any information about it.

The CHAIRMAN. Do you know what kind of country it is, so that we can get some idea about the damages that you are speaking of now?

Colonel BARDEN. No, sir; I can not give any information.

Senator GOODING. It would be very large if it was settled country.

The CHAIRMAN. Yes. That is what I am trying to find out. It is evidently in the mountains, is it not?

Colonel BARDEN. Yes, sir; it is in the mountains.

Senator HEFLIN. But, Mr. Chairman, it is like Muscle Shoals. You will remember, those who visited Muscle Shoals, that the hills are high on either side of the river. The water will never get more than half way up those hills. There is very little bottom land to be overflowed. There is a row of hills on the east side and west side of the river.

Senator MCNARY. Has any investigation been made as to whether they will hold the water?

Senator HEFLIN. What is that?

Senator MCNARY. By the impounding of it. Is it tight all around, so that water will not seep through the crevices?

Colonel BARDEN. I think no detailed examination has been made.

Senator MCNARY. That is a very important matter. In the various impounding schemes of water in the West they find that not more than half of the reservoir sites will hold the water. That is due to the structure of the mountains, of course. If you have low land you very likely would have a better reservoir that if you had to depend upon the rough sides of the hills.

Senator MCKINLEY. Colonel, just a question to clear up a point in my mind. You say there are two pools formed, one 800,000 and the other 700,000 acre-feet, both on the same river. Does that mean that one would empty into the other and it would be the same water?

Colonel BARDEN. Yes, sir.

Senator MCKINLEY. Well, then, how would you get the benefit of it down at Muscle Shoals if it is the same water?

Colonel BARDEN. If both reservoirs are full at the beginning of the low-water season, you have the total amount of water available.

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Senator GOODING. They take the peak off of the floods, you know. That is the purpose of a reservoir, to hold back the water. It not only controls the flood but increases the water supply at low-water stages.

The CHAIRMAN. The operation of these resorvoirs, as I understand it, if they work successfully, would be to increase the flow over the Dams Nos. 2 and 3 at Muscle Shoals in low water and to decrease the flow in high water?

Colonel BARDEN. Yes, sir.

Senator GOODING. You have not any definite information in regard to those reservoirs?

Colonel BARDEN. No, sir.

The CHAIRMAN. Of course, whether that could be done would depend, first, upon whether, as Senator McNary says, it would hold water. If those hills will not hold water, there is no use fooling with it. Second, it would depend upon the cost.

Colonel BARDEN. No detailed field examination has been made, as I understand it. This is just preliminary reconnaissance.

The CHAIRMAN. Is this officer that you speak of making a detailed examination?

Colonel BARDEN. I don't think he has money to make borings and detailed plans. I am not fully advised as to that point, but that is my information.

The CHAIRMAN. All right.

Colonel BARDEN. There will be available a certain amount of what is known as pondage or daily storage which can be used at Dam No. 2 without interfering with navigation. This can not be used to increase the primary power. It has no influence on the primary power, because at times of low water the entire amount of water flowing in the river must be allowed to pass continuously in order not to interfere with the navigable depth below. But, at all stages above the lowest, this method can be used and will decrease the amount of steam power required to convert the hydro power into primary.

We would like to emphasize the fact that our estimates of cost have been made on a liberal basis with a view to covering all sorts of contingencies, while those submitted by others are believed to be very close, with probably inadequate allowances for contingencies, such as are always likely to occur in works in river beds.

Our figures could probably be reduced as prices now stand, but the work on No. 2 would extend over a period of three years, and that on No. 3 another three years, or a total of six years, since the economical construction of No. 3 would depend upon the use of the same construction plant that is now used for the construction of No. 2.

The CHAIRMAN. It would not be economical, then, as I understand you, to commence construction of No. 3 until you have completed Dam No. 2?

Colonel BARDEN. That is our idea; yes, sir.

Senator HEFLIN. What do you mean by six years?

Colonel BARDEN. I mean our estimates are that it will take three years for the completion of Dam No. 2, and that it will take a similar length of time for the completion of Dam No. 3, and that the most economical way to construct Dam No. 3 would be to wait until the construction plant which we now have at No. 2 and which was very expensive and which would be equally suitable for Dam No. 3, is available.

Senator HEFLIN. Then you mean that both will be completed in six years?

Colonel BARDEN. Yes sir. That would be our idea.

Senator HEFLIN. Could both of them be built at once and be completed in three years?

Colonel BARDEN. If you started on Dam No. 3 at the same time we start the completion of Dam No. 2, they could be.

Senator NORBECK. You mean the work will be more economical if you use the same machinery and equipment used in the construction of Dam No. 2 for constructing Dam No. 3?

Colonel BARDEN. Yes sir.

Senator GOODING. Is the country ready for all this additional power? It would take some time to develop that, so that it would be economy to go on and build one dam at a time?

Colonel BARDEN. It certainly would if the power was to be used for commercial purposes.

Senator GOODING. The country would develop sufficiently to take care of it all in a year or two or three years, possibly.

Colonel BARDEN. Oh, no, sir. It would take more time.

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Senator GOODING. To develop the country?

Colonel BARDEN. To develop the country to use all of the power.

Senator GOODING. It is an immense amount of power, and it is economical always to complete one thing first?

Colonel BARDEN. Yes.

I think perhaps I might say why we considered it would take three years to complete Dam No. 2. This period is determined by the methods employed for the stream control. In other words, certain parts of the work have to be done during low-water periods. We have now two channels in which no work has been done other than the construction of a bridge across it, shown by this diagram. This upper portion of the drawing represents the dam as it will be when completed [pointing]. This is the top of the pool or the elevation of the pool right along here. This is the lock end and this is the power-house end. This is the central part of the River, Jacksons Island, on which most of the work has been done. On the north side of the river a cofferdam was constructed extending about 650 feet into the river, and in that cofferdam excavations have been made and concrete placed to the extent shown in yellow.

On Jacksons Island a short cofferdam was built on each side of it, inclosing a total distance of 1,250 feet, and in all of that section the excavation has been completed and concrete is placed to the extent shown.

Similarly, at the power-house end we have a cofferdam about 832 feet out into the river, inclosing some 12 acres, in which a considerable amount of excavation—something over 130,000 yards of rock—has already been accomplished, and a limited amount of concrete placed. The cofferdam in which this work on the north shore was constructed has been removed, as well as the cofferdams at the two sides of Jacksons Island, the work therein having been completed to a point that would permit their removal, and the flow of the river is through openings which have been left in the concrete. These openings will remain until the final step of closing the dam. The next step in the work should be done this low-water season if we have the funds available, and it would be to close off this north channel of the river, in which no work has been done as yet; put a cofferdam across that, excavate the rock, and bring the concrete up to the same stage as shown here, 7 feet above the original river bed, with 12-foot piers carried up as far as convenient. Then that cofferdam will be removed before the next high-water season, and the river will then be flowing through all these openings and through the unobstructed south channel.

At the next low-water season we would similarly cofferdam off the south channel, make the excavation, and bring the concrete to this same stage, at which time we would have 42 openings, alternately 30 and 38 feet wide, through which the river will be flowing. The river bed elevation will have been raised 7 feet. That cofferdam will have to be taken out at the end of the second low-water season.

Then, in the third low-water season we will proceed to fill in these openings, raising the pool gradually. We would bulkhead off four or five openings at a time, and put in perhaps 5 or 6 feet of concrete, and continue that all the way across the river, by which we will have raised the pool about 5 or 6 feet. That process will be continued until the dam is carried up to the full height.

That method, you see, will take three low-water seasons, and would carry the completion of the dam into the winter of 1924 and 1925, and that will also require——

The CHAIRMAN (interposing). Colonel, before you leave your map there—I don't know whether the committee all understand it or not—but explain to them from that map that at the top, above the yellow, above the concrete when it is finished, the river will run through concrete openings there, and on the top, then, still higher, will be a bridge?

Colonel BARDEN. Yes, sir. This line represents the top of the concrete. Up about here, or 18 feet above, will be the top of the gates which operate between these piers which carry the roadway across from the north bank to the south bank, on this concrete arch bridge. Between these piers are gates 18 feet high and 38 feet wide, which maintain the pool elevation at a fixed height. When the river rises to such a point that there is more water flowing than will go through the wheels of the power house, those gates will be raised, one by one, as may be necessary, to prevent the water from rising above the fixed pool elevation, and therefore flooding more land than has been acquired.

Senator HEFLIN. When you get that bridge completed, Jackson Highway or Lee Highway will cross the river at that point, will it not?

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Colonel BARDEN. Yes, sir. That is a highway bridge.
The CHAIRMAN. Is Dam No. 3 to be equipped similarly?
Colonel BARDEN. Yes, sir.
The CHAIRMAN. The same kind of dam exactly?
Colonel BARDEN. Yes, sir. Dam No. 3 will be similar in all essentials to this dam. It is a lower dam, having a lift of about 40 feet as compared with 97 feet here, and is longer, about 6,700 feet, as against 4,500 feet for this one. Of course, the amount of power developed will be proportionately less—a little over 40 per cent of what will be developed here.
Senator HARRISON. How will its cost compare with this one?
Colonel BARDEN. Our estimate of the cost of building Dam No. 3 is $25,000,000.
The CHAIRMAN. Dam No. 2, when completed, will have cost how much?
Colonel BARDEN. About $45,500,000, with the entire 18 units.
The CHAIRMAN. Yes. Well, say equipped with eight units?
Colonel BARDEN. Equipped with eight units, it would be about $40,300,000.
Senator HEFLIN. Dam No. 3 will not cost but little more than half what the Wilson Dam will cost?
Colonel BARDEN. That is right. But little less than half of the power will be developed there also.
The committee, of course, will understand that as the work now stands navigation is permanently blocked. What channel was available there before has been entirely blocked by this heavy mass of concrete which is shown here [indicating]. The channel is on the north bank of the river.
Senator HEFLIN. That is where the boats passed?
Colonel BARDEN. That is where the boats passed.
Senator HARRISON. And it has been blocked since about when—1916?
Colonel BARDEN. No, sir. About the winter of 1918–19.
Senator MCKINLEY. But, Colonel, there is a space between that dam and that bank over there.
Colonel BARDEN. In there? No, sir.
Senator MCKINLEY. No; on the other side of the river.
Colonel BARDEN. No, sir.
Senator MCKINLEY. Does that concrete go right up against the side of it?
Colonel BARDEN. What you are thinking of is that little narrow opening, perhaps.
The CHAIRMAN. I think the Senator is thinking of the excavation that is made there for the locks.
Senator MCKINLEY. I am thinking that it is not impossible for them to carry that water way around. You can get around that block of concrete.
Colonel BARDEN. This is the only practical place here [indicating].
The CHAIRMAN. The Senator, I think, Colonel, was thinking of the space there where the locks are partially excavated.
Colonel BARDEN. Yes; but that is up 75 feet above the river.
The CHAIRMAN. Yes; I think so. I think he is mistaken about it; but that is what he is thinking about, I think.
Senator GOODING. Well, Colonel, is this work here going to develop a cheap power as compared to other great plants that are developed in the country? How does it range in that respect? Is that construction cheap?
Colonel BARDEN. I don't think that it is as cheap as has been represented in some public statements.
Senator GOODING. Do you know how it compares with the Niagara development or the development on the Mississippi at the Keokuk Dam?
Colonel BARDEN. I will give what I have on that, and it must be taken for what it is worth.
Senator MCKINLEY. In the figures you are going to give do you figure anything for interest?
Colonel BARDEN. I will explain, Senator, just what I have done, and, as I say, you can assign just as much weight to this as your judgment indicates you should.
I have done this: I have assumed that we will complete this Dam No. 2, with eight units, at a cost of about $23,177,000, and we will take 9 per cent on that figure as the annual cost, 4 per cent of that being for interest and 5 per cent for the cost of operation, depreciation, and obsolescence.
Senator MCKINLEY. It makes no allowance for the other $17,000,000?
Colonel BARDEN. Making no allowance in this figure for the other $17,000,000.
The CHAIRMAN. In other words, now, so you will get it right on the record,

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you are going on the theory that we make no charge whatever for what has been expended in the past, but we start now and complete that dam?

Colonel BARDEN. We start now and assume we will complete it for eight units at a cost of $23,177,000.

The CHAIRMAN. That is making no calculation on past expenditures?

Colonel BARDEN. Making no calculation on past expenditures, and that we have got to get 9 per cent on that per annum, which will be $2,086,000.

Senator MCKINLEY. How much?

Colonel BARDEN. $2,086,000 per year.

Now, I also assume that we will run the steam plant at No. 2 to convert as much of the secondary power of this dam into primary as can be done by the operation of that plant.

Senator GOODING. Is that the practice in all great hydroelectric plants, to have the steam power to build up the secondary power?

Colonel BARDEN. I think it is.

Senator GOODING. You think it is?

Colonel BARDEN. Yes, sir.

Senator GOODING. I did not know.

Colonel BARDEN. Except in the case of the Niagara plants, where you have a constant flow of the river, but in ordinary streams that is usual.

Senator GOODING. Does that mean cheap power, though, where you have a duplication of plants?

Colonel BARDEN. It is cheaper than steam power alone.

Senator GOODING. It is cheaper than steam power alone, but that is not the ideal power after all. It is not cheap power after all?

Colonel BARDEN. It is the cheapest that is available, I think, Senator.

Senator GOODING. I am thinking of cheap power.

Senator MCKINLEY. It is commercial power?

Colonel BARDEN. It is commercially practical.

Senator MCNARY. What do your figures show?

Colonel BARDEN. Our estimate for the operation of the steam plant, Senator, is on the basis of $15,000 for labor per month, $172,800 for coal, $12,200 for miscellaneous supplies, making a total of $200,000 per month. Now, that will have to be run for probably three months, so I have assumed that we will have for three months' labor at $15,000, $45,000, and $30,000 labor for the remaining 9 months, because some part of the force will have to be kept there the year around; that the coal will be $500,000, and miscellaneous supplies $25,000, or a total of $600,000 for the operation of that steam plant for the portion of the year that is required. Then we must take 4 per cent interest on the value of the steam plant, which I placed at $9,000,000, and another 4 per cent for depreciation and obsolescence, making a total for the steam plant per annum of $1,320,000.

Senator MCKINLEY. A commercial company would charge 14 per cent?

Colonel BARDEN. As I say, I give these figures for what they are worth.

Senator MCKINLEY. Yes.

Colonel BARDEN. That would make the total charge per year, $3,406,000. Now, if we took our primary horsepower as 87,300 and add to it the 80,000 horsepower that we get from the steam plant, we have a total primary power in that way of 167,300 horsepower, which will cost $20.30 per year.

The CHAIRMAN. Per horsepower?

Colonel BARDEN. Per horsepower per year; yes, sir.

Senator GOODING. What is that figure?

Colonel BARDEN. $20.30 per horsepower per year.

Senator MCNARY. Have you reduced that to kilowatt hours?

Colonel BARDEN. Yes, sir. That price includes the secondary. All your secondary that you get beyond that is free.

We have an installation here of 8 units, which provides for a total of 240,000 horsepower, and I am only using here 167,300 of it, so that whatever secondary power there is over that goes in for nothing on that basis.

Senator MCKINLEY. Well, that horsepower, in the normal way of using it, would be about 40 per cent efficiency, which would cost you something like 10 mills, wouldn't it?

Colonel BARDEN. At 80 per cent load factor it would be about 3.88 mills, and at 60 per cent it would be 5.18 mills per kilowatt hour.

Senator MCNARY. How much is that per kilowatt hour?

Colonel BARDEN. 5.18 mills per kilowatt hour on a 60 per cent load factor.

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Senator GOODING. What is the commercial price, generally, per kilowatt hour? It varies, of course.

Senator HARRELD. Whatever they can get.

Senator GOODING. I know, but there is an average figure. I wanted to get the average.

Colonel BARDEN. The Chief of Engineers, in his testimony before the House committee, said that the Southern power companies told him that they got an average of 9 mills per kilowatt hour.

Senator HARRELD. How much per horsepower?

Colonel BARDEN. Per year?

Senator HARRELD. Yes.

Colonel BARDEN. About $51.

Senator MCKINLEY. What load factor are you taking?

Colonel BARDEN. Sixty.

Senator MCKINLEY. Is that about the heaviest?

Colonel BARDEN. It depends on the use you make of it, of course. The manager of the Tennessee Copper Co., which has a plant in east Tennessee, told me that several years ago he made a contract with the Tennessee Power Co. for $25 per horsepower per year, and then during the war, when prices went up, the company wanted to raise the price, and he agreed to pay them $40; but that now they wanted to raise it to, I think, $60, and he was demurring at that. That is an indication of what is paid in that locality.

Senator HARRELD. In other words, they get whatever they can get.

Colonel BARDEN. Yes, sir.

Senator HARRELD. Whatever the people will stand for.

Colonel BARDEN. We use a small amount of power at the dam, which we buy from the Alabama Power Co., and our price is about a cent and a half per kilowatt hour.

Senator HARRELD. Let me ask you this question. Is it not true that there is more demand for power that is certain than the present plants can supply in that section?

Colonel BARDEN. I would not like to answer that.

Senator HARRELD. What I am trying to get at is what market there is for that power there at this time?

Colonel BARDEN. I have this paragraph about the market, Senator, to answer your question.

The total kilowatt hours available from this eight-unit installation would be 1,315,962,800. The letter from the Tennessee and Georgia power companies to the Chief of Engineers quoted in the testimony of the latter before the House committee, stated that the demand for power in the southeastern territory would absorb 500,000,000 kilowatt hours, or a little less than half of it, by 1927. During the war General Keller examined the power situation in the South and elsewhere, and his report, which was published afterwards, estimated that 1,000,000,000 kilowatt hours would be needed in the southern territory in from five to seven years. So that I think those two investigations——

Senator MCKINLEY. In five to seven years?

Colonel BARDEN. Yes, sir. One of these estimates says they can use about 500,000,000 kilowatt hours by 1927, and the other investigators think they can use a billion in the next five to seven years.

The CHAIRMAN. Colonel, I wanted to ask you something about the load factor.

Senator HARRELD. Before you get away from that, let me ask you this:

Have you any statistics showing what the percentage of the primary and secondary power of these various hydroelectric plants that have been constructed in the past has been? That is, whether 60 per cent of the power or 50 per cent or 75 per cent of their available power is primary?

Colonel BARDEN. I think all of these southern power companies are disposing of all their available power, and are increasing their power. The Alabama Power Co. is building a new dam now on the Coosa River, just below their present dam, at which the ultimate installation will be 120,000 horsepower, and I think the Georgia power companies are increasing their capacities, and, if I am not mistaken, the Carolina power companies also are increasing their installations. In other words, there is a market for all the power that is now available.

Senator NORBECK. I understand that while there is a market for all the power available, still the load factor may be only 30 to 40 per cent. While there is a market for all of it, there is likely some to go to waste anyhow.

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Colonel BARDEN. The average load factor of the South is about 50.

Senator NORBECK. So that when you speak of all the power available having a market, only about half of it is being used?

Colonel BARDEN. Yes, sir.

The CHAIRMAN. Taking up that matter which I started to inquire about when I was interrupted, does not that depend upon the business that they are using it for?

Colonel BARDEN. Yes, sir.

The CHAIRMAN. For instance, if you were operating a street railway you would have an entirely different load factor than if you were using it for something that consumed the same amount of power 24 hours of the day?

Colonel BARDEN. Yes, sir.

The CHAIRMAN. Assuming that we are going to use this plant, instead of selling the power to anybody, we are going to make fertilizer out of it, would not the load factor be the same all the time?

Colonel BARDEN. It would be 100 per cent.

The CHAIRMAN. Could we not use there, in making fertilizer, the entire amount of power that would be generated?

Colonel BARDEN. Well, the present nitrate plant requires for operation at full capacity only 110,000 horsepower.

The CHAIRMAN. Yes.

Colonel BARDEN. So that that amount of power could be used continuously.

The CHAIRMAN. That is, not counting the other plant.

Colonel BARDEN. No, sir.

The CHAIRMAN. That is at the cyanamid plant. Now, if that other plant is developed and improved so that it can operate to its capacity, how much power will that take?

Colonel BARDEN. That takes just a small amount of power, Senator, and they have their own plant.

The CHAIRMAN. They have a steam plant?

Colonel BARDEN. Yes, sir.

The CHAIRMAN. It will be cheaper to operate by water power?

Colonel BARDEN. I think that is about 5,000 kilowatts.

The CHAIRMAN. The cyanamid plant would require a small amount of power?

Colonel BARDEN. I think it is 5,000 kilowatts.

The CHAIRMAN. Then, after all, we would have developed more power than it would take to operate the Government plants there?

Colonel BARDEN. Yes, sir.

The CHAIRMAN. So that the load factor would cut some considerable figure?

Colonel BARDEN. Yes, sir.

Senator HEFLIN. This power produced by water is much cheaper than that produced by steam. That is a correct understanding?

Colonel BARDEN. Yes.

The CHAIRMAN. Colonel, let me ask you about this quarry we have over there from which we get the limestone that is necessary. I think that is about 1,200 tons a day, if they operate this cyanamid plant to its capacity, isn't it? How is that operated? What power is used for that?

Colonel BARDEN. It is connected now with the line from Gorgas, of the Alabama Power Co.

The CHAIRMAN. Has it any connection with this other plant?

Colonel BARDEN. Yes, sir.

The CHAIRMAN. They could operate there by electric power?

Colonel BARDEN. Yes, sir. That is right.

The CHAIRMAN. How much power will that take? Is it quite an item?

Colonel BARDEN. I don't know.

Major BURNS. I have not got the figures, but it is rather a small quantity.

The CHAIRMAN. Would it be a practical proposition to fix these railroads that the Government owns so that they will operate and have to continue to operate a great many of them in connection with the cyanamid plant—would it be practical to operate them by electricity and do away with the steam engines and work those from the water power?

Colonel BARDEN. I think I would rather you would ask Major Burns that question.

The CHAIRMAN. All right; we will ask him later.

Colonel BARDEN. There will be none of that required in the operation of the dam, at least.

The CHAIRMAN. You are not a chemist?

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Colonel BARDEN. No, sir.

The CHAIRMAN. I understand they will have to bring in a great deal of rock. My recollection is 1,200 tons a day will be required to operate that cyanamid plant.

Colonel BARDEN. I understand that is brought over a commercial railroad.

The CHAIRMAN. Yes; is that true?

Major BURNS. That is correct; yes, sir.

Senator HEFLIN. Is that phosphate rock?

Colonel BARDEN. No, sir; he is speaking of the rock from the Waco quarry.

Senator HARRELD. You mean rock that is now used there for making cyanamid?

Colonel BARDEN. Yes, sir.

I was speaking of our estimates of costs and saying that I believed they were very conservative, and that we believe in view of the experience already had in the conduct of this work and studies made and plans prepared for its continuance, that it could be completed by this office at substantially as low a figure as by any other agency. The only material saving that could probably be made by a private concern would possibly be by paying perhaps not quite so good wages as we do, and possibly by not adhering to the 8-hour law, but it is a question as to whether this latter would not be required if the money for the work were being furnished by the Government.

It is hoped that the recommendation of this committee for an appropriation for immediately resuming construction work on Dam No. 2 may be adopted by Congress.

Construction plants and particularly cofferdams and temporary buildings of all kinds depreciate at the rate of approximately $400,000 per year. Unless some action is taken very soon a full working season will be lost and completion of the dam postponed at least a year. Such an appropriation need not interfere with nor prevent the acceptance of any offers now under consideration or that may be subsequently made. They can be readily amended to meet the conditions existing at the time of acceptance.

The amount recommended will be sufficient for a year's operation.

Senator HARRELD. What would be, in your opinion, the latest date on which this appropriation could be made available for this year's use?

Colonel BARDEN. Well, sir, if it were made available on the 1st of July, we have a small balance which would be sufficient to permit us to start our preliminary work.

Senator HARRELD. Of course, you have enough there to do the preliminary work, to go ahead and do preliminary work leading up to the regular work?

Colonel BARDEN. Yes, sir.

Senator HARRELD. And you have to know whether the balance will be available by a certain time in order to get ready for this season's work. Now, what is the latest possible time that you think this work could be started? In other words, how soon do you think this bill ought to be passed to get the best of this season's work?

Colonel BARDEN. I think if we knew within 30 days that the bill were going to be passed we could go ahead and be able to take full advantage of the season.

Senator HARRELD. You think it is advisable that the War Department be informed in 30 days whether or not the work will proceed?

Colonel BARDEN. That would be very desirable; yes, sir. It is possible that the 1st of June would be soon enough.

The CHAIRMAN. What you mean is, as I understand it, that 30 days after you know work is going to proceed you could be working? Is that your idea?

Colonel BARDEN. No, sir; that is not the idea.

The CHAIRMAN. That is not the idea?

Colonel BARDEN. Yes, sir. It is that if we know by the middle of May or by the 1st of June, possibly, that we will have funds available on the 1st of July we have enough balance now in hand that would permit us to start work.

Senator HARRELD. But you would not want to start unless you knew that the appropriation would be made?

Colonel BARDEN. That is correct. If we knew by the middle of May or the 1st of June that we were going to have the money by the 1st of July, then I think we could take full advantage of this coming low-water season.

Senator KEYES. The only way to know is by the passage of the act.

Colonel BARDEN. That is the only way; yes, sir.

Senator HEFLIN. In other words, if you knew you were going to have this money, you would go ahead with your preliminary arrangements and be ready to go ahead with the regular work on the 1st of July?

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Colonel BARDEN. Yes, sir.

The CHAIRMAN. Now, Colonel, right along that line I want to ask you a few questions about the plant. I mean the railroad and bridge and the mixing plants and the engines and the cars, and everything. If the Government were to quit work and individuals were to take it up, they would either have to buy out the Government in getting the plant or duplicate it, practically, in order to do any work, wouldn't they?

Colonel BARDEN. Yes, sir.

The CHAIRMAN. Then, as a matter of fact, the Government is situated, is it not, having all this plant there so that it can do this work on Dam No. 2 cheaper than anybody else could possibly do it, even though they paid less wages and worked longer hours?

Colonel BARDEN. Unless the plant were turned over to them without any charge.

The CHAIRMAN. I understand, unless the Government gave them the plant.

Colonel BARDEN. Yes, sir.

The CHAIRMAN. And it would take, if we had no plant there or if this were destroyed and taken out and somebody started now to fix up a plant, a year or so to get ready to do any work, would it not?

Colonel BARDEN. Yes, sir; fully that.

The CHAIRMAN. So that, no matter who does it, if not done by the Government, in order to get any expedition or any economy they would have to have the Government's working plant?

Colonel BARDEN. Yes, sir. I think that all the offers already before Congress contemplate that all the Government's plant and property should be turned over.

The CHAIRMAN. Yes; I think so. Otherwise they would be a year or so getting ready for work.

Senator MCKINLEY. Perhaps you will have to get some figures later to put in the record, if it is agreeable to the chairman, but I understand you to say that, figuring on the basis of 4 per cent interest and 5 per cent depreciation and obsolescence, you figure that you can count on about 240,000 primary power—that is, backed up by steam—at $20 per year per horsepower. Is that right?

Colonel BARDEN. About 167,300 horsepower, at $20.30.

Senator MCKINLEY. Now, I think, if it is agreeable to the chairman, you can put that in the record and figure it out, as I have just figured it here. I figure that that, on an 80 per cent load factor, would amount to about 2½ mills per horsepower.

The CHAIRMAN. Per kilowatt hour, you mean, don't you, Senator?

Senator MCKINLEY. No, sir; I mean per horsepower.

The CHAIRMAN. Two and a half mills?

Senator MCKINLEY. Yes, sir.

The CHAIRMAN. Oh, I understand; yes.

Senator MCKINLEY. I just asked that he figure it out before he puts it in and then have it printed in the record. That gives us a better idea of what we are figuring on.

The CHAIRMAN. Yes.

Colonel BARDEN. I will put that in, but our figure is a little more than that.

Senator MCKINLEY. Well, you can figure it. I might say this: That we have a cement mill on one of our powers on the Illinois River, and they paid us last year on the basis of—they paid us $150 for power, and that was pretty near 24-hour power; 80 per cent, anyhow. They paid us 8 mills for grinding cement per kilowatt hour, though. That would be about 6 mills per horsepower hour.

Colonel BARDEN. There is another way of looking at this.

Senator MCKINLEY. You can figure it out a little later.

The CHAIRMAN. Yes; and put the figures in the record.

NOTE.—The figure is 2.9 mills per horsepower hour.

Colonel BARDEN. Here is another matter that I may take up now. If we assume that the available power at dam No. 2, the primary power, be sold on a 60 per cent load factor for 3 mills per kilowatt hour, the yearly return would be $1,023,486. If the secondary power, amounting to 447,415,800 kilowatts, should be sold for 1.16 mills——

Senator MCKINLEY. How long is that secondary power for?

Colonel BARDEN. Seven months.

Senator MCKINLEY. Can you keep an organization together and run seven months?

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Colonel BARDEN. I was just making this assumption.

Senator MCKINLEY. I know, but you get a lot of wild figures in there, you know, and they fool the people.

Colonel BARDEN. Well, in the testimony before the House committee they have used even wilder figures than I am using. Mine are more conservative than anything that has been presented up to date, I imagine. As I say, I am giving these figures for what they are worth.

If you assume that the secondary power can be sold for 1.16 mills, we will have a return of $519,014 from the secondary power, or a total return of $1,542,500, which is approximately 7 per cent on the amount of money required to complete the plant. I was just giving this to the committee as showing some of the possibilities from what would seem to me to be a reasonably conservative viewpoint, if the Government sold the power. The Alabama Power Co., in its offer, if you will recollect, agreed to give the first 100,000 secondary horsepower free, and said that that was estimated to be worth $7.53 per horsepower per year, or 1.16 mills per kilowatt hour.

Senator MCKINLEY. They proposed to take out only 100,000 horsepower.

Colonel BARDEN. Their proposal is to give to the Government or to anyone whom the Government indicates, 100,000 secondary, the first 100,000 secondary horsepower. I think their offer does not say how much they are going to consider as primary, so I don't know how much they would take out as primary. Is that your question?

Senator MCKINLEY. I was under the impression that they said about 100,000 primary.

Colonel BARDEN. I think their offer was indefinite on that point.

Senator HARRELD. The primary power is a matter of calculation, is it not?

Colonel BARDEN. It is more or less a matter of arbitrary determination, Senator. The absolute primary is fixed, but commercially it is more or less arbitrarily determined.

Senator NORBECK. The secondary power might be that power which was available only 30 days a year, and then, under certain conditions.

Colonel BARDEN. Yes, sir.

Senator MCKINLEY. Your estimate is that with the steam plant that is there, there is 167,300 primary power?

Colonel BARDEN. With the steam plant; yes.

Senator HEFLIN. That is available all the year?

Colonel BARDEN. That would be available all the year.

The CHAIRMAN. That is what makes primary power?

Colonel BARDEN. Yes, sir.

The CHAIRMAN. That is the definition of it, but the secondary power may be very valuable or practically worthless, depending on what proportion of the year it could be used as power.

Colonel BARDEN. And what particular purpose it could be used for.

The CHAIRMAN. Yes. As Senator Norbeck has said, if the secondary power lasted only 30 days in the year it would not amount to much.

Colonel BARDEN. No, sir; not for any purpose.

The CHAIRMAN. If that same power lasted 11 months in the year it would be very valuable?

Colonel BARDEN. Yes, sir.

The CHAIRMAN. So that you have there the two extremes, and it could be anywhere between the two?

Senator HEFLIN. Do industrial plants use primary power principally, or do they use secondary?

Colonel BARDEN. Primary, ordinarily.

The CHAIRMAN. They convert secondary power into primary power by the use of auxiliary steam plants, do they not?

Colonel BARDEN. Very often; yes.

The CHAIRMAN. Now, Colonel, I have so often said, and I wonder if it is right, that the weakness of this whole proposition, in fact, the weakest point in it all, is the great difference between the maximum and the minimum flow of the Tennessee River?

Colonel BARDEN. No, sir. I think the weakest point in this proposition is the width of the river.

The CHAIRMAN. That is, it makes it too expensive to build a dam?

Colonel BARDEN. It makes it so expensive to build a dam. If it had not been for that the power would probably have been developed many years ago.

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The CHAIRMAN. I can see how that is a weakness, but there is a tremendous difference between the maximum and the minimum flow of the river.

Colonel BARDEN. Not more than for most of the streams of the country.

The CHAIRMAN. Is it not more than most of the northern streams, for instance?

Colonel BARDEN. Not more than the southern streams.

The CHAIRMAN. Perhaps it compares favorably with the southern streams, but they flow by quicker than the northern streams anyway, don't they, because they get no part of their supply from snow, and that in itself, in some parts of the country, performs the service of a reservoir.

Colonel BARDEN. Of course, the Niagara and St. Lawrence Rivers are in a class by themselves.

The CHAIRMAN. Yes; I think so. That is steady and constant all the time.

Colonel BARDEN. That is the ideal situation. I am not sufficiently familiar with the power development on other northern streams to say whether the variation between extreme low water and flood water differs greatly from those of the southern rivers, but I don't think there is a great deal of difference.

The CHAIRMAN. In Dam No. 2 you have a flow of the river that comes down so you get a minimum power of 87,300, and you have figured it up, and never got through figuring, and it runs up as high as 1,106,000. It is claimed by others that it goes as high as 3,000,000.

Colonel BARDEN. I may answer that in another way. The minimum flow for 87,300 horsepower is 10,000 cubic feet a second. Now, our maximum flood record is about 440,000.

The CHAIRMAN. I guess we will have to quit now. We will adjourn until 10.30 to-morrow.

(Whereupon, at 12 o'clock noon, the hearing was adjourned to 10.30 o'clock a. m., Wednesday, April 12, 1922.)

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MUSCLE SHOALS.

WEDNESDAY, APRIL 12, 1922.

UNITED STATES SENATE.
COMMITTEE ON AGRICULTURE AND FORESTRY,
Washington, D. C.

The committee met, pursuant to adjournment, at 10.30 o'clock a. m., in room 224, Senate Office Building, Senator George W. Norris presiding.

Present: Senators Norris (chairman), McNary, Ladd, Harrison, and Heflin.

The CHAIRMAN. The committee will come to order, and Colonel Barden will proceed.

STATEMENT OF W. J. BARDEN, COLONEL, UNITED STATES ARMY—Resumed.

Colonel BARDEN. Senator, I have very little more to add unless the committee want to ask further questions.

I referred in the first part of my testimony briefly to what might be called the value to navigation of this project, and the fact that in 1916 the Engineer Department, as set forth in House Document 1262, Sixty-fourth Congress, first session, was, in general, favorable to entering into an arrangement with the Muscle Shoals Hydroelectric Power Co., by which "this serious obstruction to navigation on the Tennessee River will be overcome, and at the same time one of the great natural resources of the country will be conserved," the net cost chargeable to the United States being $8,573,000, though provisions for payment for horsepower would have ultimately still further reduced that amount.

As I explained, this recommendation had been made by the Board of Engineers that investigated this matter, or, rather, by the Engineer officer who investigated it for the Board of Engineers for Rivers and Harbors, but the latter board, in view of the fact that this national defense act, which contained the provision for $20,000,000 for the nitrate plant, was pending, recommended that action on this particular proposition be withheld until it was determined what was to be done about this nitrate question.

The "value to navigation" of such a combined scheme for power and navigation is a somewhat indefinite term. Assuming these two dams to be built for the development of power only, the cost of providing for navigation would be merely the excess cost of putting in locks over that of a solid section of dam across the upper end of the lock and into the abutment. The approximate cost of this would be $2,860,000 for Dam No. 2, and $4,125,000 for Dam No. 3, or $4,285,000 for both dams.

The pool formed by Dam No. 2 extends some 15 miles upstream, and that formed by the proposed Dam No. 3, on account of the flatter slope of the river above, would be over four times as long. The two dams together will provide 6-foot navigation from the site of Dam No. 2 to Flint River, a distance of approximately 80 miles.

The cheapest way in which navigation could be provided over this stretch of river would be by (*a*) dredging and the construction of low dams or dikes in the river above the upper section of the present Muscle Shoals Canal; (*b*) the construction of a low dam across the river at Lock No. 1 of the lower section of the present canal to provide sufficient depth in the 8 miles of open river between the two sections; and (*c*) the construction of a lock at the site of Dam No. 2, or the Wilson Dam, with low dams connecting the islands across to the south bank to submerge the rapids at Little Muscle Shoals, and thus provide access to Lock 9 (the lowest lock) of the lower section of the existing canal. All of this work would be for the purpose of completing and making effective

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the present Muscle Shoals Canal, which can not now be used to full advantage on account of deficient depth in the river above the upper section, between the two sections, and below the lower section thereof. The cost would be approximately $8,600,000, but a 5-foot depth only would be provided, and the channel would be narrow and somewhat difficult of navigation. It would, of course, be far less suitable for the development of navigation than that which would be provided by the two high-power dams now under consideration.

To provide a 6-foot channel over this stretch of river the present canal would have to be reconstructed, and work done in the river above and below and between its two sections, similar to that described in the preceding paragraph, but more extensive. The estimated cost of this work would be approximately $25,786,000. This estimate is based on plans contained in a survey report of Major Harts, Corps of Engineers, of March 21, 1910, published in House Document 360, Sixty-second Congress, second session, and may be assumed as representing the best and cheapest method of providing for a 6-foot navigation over this 80 miles of river if no attention were paid to the development of power. But since large and valuable power can be developed by the completion of Dam No. 2 and the construction of Dam No. 3 at a total cost of only a little more than $50,000,000, and an even better navigable channel provided, it is not believed that any serious consideration should be given to such a scheme, and that the "value to navigation" should be considered as being something between the mere additional cost of putting locks in these two dams, namely, $4,285,000, and the cost of providing a 6-foot channel by a lateral canal, namely, $25,786,000; and probably not less than the $8,600,000, which would be sufficient to provide a 5-foot depth.

Particular attention is invited to the fact that in order to complete navigation through the Muscle Shoals section Lock and Dam No. 1 is required just above the Florence Bridge. This is a short low dam with a lift at low water of 14 feet, and provides what is in effect a lateral canal between Pattons Island and the north bank of the river. The estimated cost is $1,400,000.

The CHAIRMAN. That is entirely a navigation proposition?

Colonel BARDEN. Yes, sir.

The CHAIRMAN. It has nothing to do with power?

Colonel BARDEN. No, sir.

The CHAIRMAN. And it is not connected, as far as power is concerned, with either Dam No. 2 or Dam No. 3?

Colonel BARDEN. No, sir.

The CHAIRMAN. That is the dam near the Florence Bridge?

Colonel BARDEN. Just above the Florence Bridge.

The CHAIRMAN. And it does not extend clear across the river?

Colonel BARDEN. No, sir.

The CHAIRMAN. But extends from one side of the river to the island?

Colonel BARDEN. Yes, sir.

The CHAIRMAN. That is the same island that reaches up to Dam No. 2?

Colonel BARDEN. Yes, sir.

The CHAIRMAN. So that the channel, after that navigation dam has been constructed down to the Florence River Bridge, would be on the north side of that island all the way up to Dam No 2.

Colonel BARDEN. That is correct. There would be simply a low levee 3 or 4 feet high on the north side of the island, then a concrete wall from the upper end of the island across to the lower lock of Dam No. 2.

The CHAIRMAN. Now, Colonel, I want to get a little more elaborate idea in the record about the navigation feature.

You say that if we were to forget all about the development of power and start out on the navigation proposition entirely it would cost, in round numbers, $25,000,000 to make the Muscle Shoals navigable to a depth of 6 feet?

Colonel BARDEN. Over the section of the river——

The CHAIRMAN (interposing). Over the same section that will be made navigable 6 feet by the building of Dams Nos. 2 and 3?

Colonel BARDEN. Yes, sir.

The CHAIRMAN. Now, then, your plan, if you did not have these dams, to carry out that plan of navigation would in fact be a canal, would it not?

Colonel BARDEN. It would be a lateral canal.

The CHAIRMAN. The navigation would not be as rapid through that canal as it will over the river itself if dams Nos. 2 and 3 are built?

Colonel BARDEN. That is correct.

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The CHAIRMAN. In other words, even if you spend $25,000,000 to make this part of the river navigable, its navigability would not be as practical or as good as we will have by the construction of Dams Nos. 2 and 3?

Colonel BARDEN. That is correct.

The CHAIRMAN. So that the part of these improvements that we are talking about, the construction of Dams Nos. 2 and 3, that should be charged to navigation, and the part that should be charged to power development ought in no case be less than what it would cost to make the river navigable to the same depth—that is, 6 feet—and in no case—I mean in no case more than that and in no case less than the actual additional cost of constructing the locks of Dams Nos. 2 and 3?

Colonel BARDEN. Yes, sir; $4,285,000.

The CHAIRMAN. Now, then, that price that is properly chargeable to navigation would be somewhere between $4,000,000, speaking in round numbers, and $25,000,000?

Colonel BARDEN. Yes.

The CHAIRMAN. You could not logically put it above $25,000,000 and you could not logically put it below $5,000,000, and men may disagree as to where it should be between those two figures?

Colonel BARDEN. Yes, sir; but, in my opinion, it should not be put much less than $8,600,000, which is the cost of getting 5-foot navigation; in other words, the cost of completing the incomplete canal.

The CHAIRMAN. Five feet is not as good as six, of course?

Colonel BARDEN. No. I have put the lower limit $8,600,000 rather than $4,285,000.

The CHAIRMAN. And as to just where you would put that figure between $4,000,000 and $25,000,000 will have a very important bearing on what you would say would be the cost of the development of any unit of power?

Colonel BARDEN. Yes, sir.

The CHAIRMAN. Have any members of the committee anything further to ask?

Senator MCNARY. In the completion of the project as suggested by the chairman, to what extent would the river be navigable?

Colonel BARDEN. I am not certain that I know what you mean.

The CHAIRMAN. He has already given testimony on that.

Colonel BARDEN. You are referring to both dams?

Senator MCNARY. Yes, sir.

Colonel BARDEN. From the mouth of the Flint River.

Senator MCNARY. Between what points?

Colonel BARDEN. From the location of Dam No. 2, the Wilson Dam, 3 miles above Florence, to the mouth of the Flint River, a total distance of 80 miles.

The CHAIRMAN. Let Mr. Williams point that out on the map here.

Senator HEFLIN. What is that point where you place your finger there?

The CHAIRMAN. That is Dam No. 2.

Colonel BARDEN. The Wilson Dam.

Senator MCNARY. Have you ever made an estimate of the commerce that would probably pass along the river in case of the completion of this improvement?

Colonel BARDEN. No, sir. I could not give that.

Senator MCNARY. Is there reason to believe that it would be considerable and add to the economic welfare of that section of the country?

Colonel BARDEN. I think it would.

Senator MCNARY. What railroad lines serve the commerce contiguous to the river?

Colonel BARDEN. The Southern Railroad parallels the river on the south bank from Florence to Decatur and then crosses to the north bank and follows up that bank to Stevenson, where it again crosses to the south.

The Louisville & Nashville Railroad crosses the river at Decatur in the north and south direction.

Senator MCNARY. Then there are two railroad lines that serve that section of the country on either side of the Tennessee River?

Colonel BARDEN. Well, there is only one paralleling the river.

Senator MCNARY. The freight to move in bottoms on the river would be local freight, passing from city to city, would it not?

Colonel BARDEN. Well, not local; no, sir. The idea would be that freight would go down the river to St. Louis or even up the Ohio River.

Senator MCNARY. Then cotton is largely raised in that section of the country?

Colonel BARDEN. Yes.

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Senator McNARY. Do you think cotton would move to the principal ports along that river rather than be shipped by rail to tidewater?

Colonel BARDEN. I would not say that under the present conditions. It is, perhaps, not probable that such would be the case, but it would be possible. And I would also like to state for your information that there are iron furnaces both at Florence and Sheffield, and that they are now actually shipping pig iron by water from Florence down the river. I do not know the destination, but when I left Saturday night a barge was being loaded.

Senator McNARY. If the minimum which you want to charge against this improvement to make the river navigable is $8,000,000, do you consider that a good investment from the standpoint of the commerce that would probably flow up and down the stream?

Colonel BARDEN. Well, I avoided saying that, Senator. I limited my statement to what would be necessary to provide for navigation. As to whether under present conditions, the Government would be justified in spending that amount of money purely for navigation I would not want to commit myself further than to say that the Engineer Department is on record in 1916 as saying that an expenditure of $8,575,000 was advisable.

Senator McNARY. From the standpoint of commerce?

Colonel BARDEN. Yes, sir.

Senator McNARY. Is that the Government Engineer Department?

Colonel BARDEN. Yes, sir; the Board of Engineers for Rivers and Harbors and the Chief of Engineers.

Senator HEFLIN. Senator McNary, this Muscle Shoals site there is right in the heart of the coal region and phosphate rock beds and the finest timber region in the country, nearly, and cotton, I have no doubt, would go down this river instead of going on the railroad, practically all of it from the Tennessee Valley.

Senator McNARY. Don't you figure that if it goes by water down the Tennessee it must be reloaded at tidewater into larger vessels if it goes to the markets of the world?

Colonel BARDEN. That would undoubtedly be true.

Senator McNARY. Can you compete with one loading on the railroad?

Senator HEFLIN. It would be cheaper then, I understand. The water rate is cheaper than the rail rate.

The CHAIRMAN. When you get into that, gentlemen, you get into the question of rates. That is, in the first place a very complicated question and, in the next place, a rather unsettled one. As a matter of fact, however, it is demonstrated right in this section of the country, south of it on the Warrior River—just south about 80 miles here is the Warrior River, that flows into, I think, the Tombigbee?

Colonel BARDEN. And the Tombigbee into the Alabama.

The CHAIRMAN. Then into the——

Senator HEFLIN. Mobile Bay.

The CHAIRMAN. Into Mobile Bay. Now, there is a line of boats now making regular trips from New Orleans up to the head of navigation on the Warrior River. They are Government boats. They are not quite paying expenses at the present time. I had quite a talk with the official in charge of it, who was very enthusiastic about his work, and he told me why. He apparently showed a very good reason why it was not paying expenses. One was that the barges that he was operating were barges constructed for work on the Mississippi River in time of war by the Government, which cost the Government $600,000 apiece. He explained that those barges can be duplicated now by contract for not more than $175,000, but he is compelled to carry them on his books at $600,000.

Another thing was the rate situation, and the matter is now before the Interstate Commerce Commission. And this is all in line with Senator McNary's question, because it is a shipment where you have to unload and load again on freight cars, and his question was whether it would pay to do that. Here is an illustration of it: Warrior River runs within 50 miles of Birmingham, one of the largest cities of the South. They are shipping coffee that comes into New Orleans from South America by this water system from New Orleans to Birmingham, Ala. They bring it up the river to within 50 miles of Birmingham and then unload it and reload it on cars and ship it to Birmingham. Before that commenced, before they put on these boats, there was a rate being charged for all rail shipments from New Orleans to Birmingham of 53 cents per hundred. Immediately when they put these boats on the rate dropped to 43 cents a hundred. Then this difficulty occurred: Of that 43 cents a hundred

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the railroad takes 38 cents and leaves the Government boats 5 cents. The railroad part of the shipment is 50 miles; the Government part of the shipment is over 400 miles. So that the railroads are getting the best of the deal all the time.

The superintendent told me that they had this up now with the Interstate Commerce Commission. He gave me that as only an illustration of what was going on. Coffee was simply an illustration. He mentioned a great many others where it was worse; where the railroad company took it all, and they had to do all their work for nothing.

Senator HEFLIN. They ship a great deal of cotton, too, on those barges down there?

The CHAIRMAN. I think that any man who will look into it scientifically will reach this conclusion. There is a class of freight, where a railroad line runs right along the river, that ought to go by water instead of by railroad, and there ought to be a difference in rates. The railroad ought not to be allowed to cut the rate for the purpose of putting the boat out of business. That is what Germany is doing on her canals. Certain classes of freight, such as coal and cotton and other things that are not necessary to go through in a hurry, ought to go by water at a lower freight rate than a railroad would be allowed to make, and other things ought to go by rail, where time is part of the essence of the deal. Whether we can ever work that out I am not saying, but there is at least a great field there for shipping of freight partly by water and partly by rail. They ought to be made to coordinate with each other instead of one killing the other and then putting the rate sky-high as quick as they get them out of business.

Senator HEFLIN. The illustration you used, Mr. Chairman, is a very apt one. Whenever they have come in competition with the railroads down there the railroads have put down the freight rates.

The CHAIRMAN. Yes, sir.

Senator HEFLIN. Birmingham enjoys better rates than it did before the Warrior River was opened up?

The CHAIRMAN. Yes, sir.

Senator HEFLIN. If we have navigation on the Tennessee River, there is no doubt on earth about these people getting a better rate on things that they ship out on the boats?

The CHAIRMAN. I want to ask now how far Flint River, where those dams would be built, would be from the end of navigation, so far as this improvement is concerned—how far from there to the mouth of the Tennessee River?

Colonel BARDEN. Three hundred and forty miles, approximately.

The CHAIRMAN. If this improvement were made, Colonel, from there on down to the mouth of the river, would there be any other dams to construct except what is known as Dam No. 1?

Colonel BARDEN. No, sir.

The CHAIRMAN. That would be the only one, to make the river navigable 6 feet, from your Flint River clear to the mouth of the Tennessee River?

Colonel BARDEN. Six feet at ordinary low water and 5 feet at extreme low.

Senator HEFLIN. What is the condition of navigation from there toward Chattanooga?

The CHAIRMAN. There would have to be some more dams constructed.

Senator HEFLIN. The completion of these dams would make it navigable over what distance?

The CHAIRMAN. Eighty miles.

Colonel BARDEN. You mean from Chattanooga to the mouth?

Senator HEFLIN. Yes.

Mr. WILLIAMS. Four hundred and sixty-four miles from Chattanooga to the mouth.

Senator HEFLIN. You would have complete navigation for that distance?

The CHAIRMAN. No, Senator; not necessarily from the construction of these two dams. These two dams would not make it navigable from Chattanooga to its mouth. They would make it navigable from the Flint River to its mouth, excepting that they would have to put in this dam at the Florence River Bridge known as Dam No. 1.

Senator HEFLIN. I thought you were telling me the distance from that river to the mouth?

Mr. WILLIAMS. That is 340 miles. Then you asked the distance from Chattanooga to the mouth, which is 464 miles.

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The CHAIRMAN. To make them navigable from Chattanooga to the mouth there would have to be, possibly, work done besides what is proposed in the building of these two dams.

Senator HEFLIN. Both those two dams toward Chattanooga?

The CHAIRMAN. Yes; toward Chattanooga. There is no proposition to provide a depth of more than 3 feet above Chattanooga.

Senator MCNARY. I understand.

The CHAIRMAN. At Chattanooga it would be very desirable, of course, if this improvement were made, to make the river navigable up as far as Chattanooga.

Colonel BARDEN. Yes, sir.

The CHAIRMAN. Because that is one of the great manufacturing cities, and there would be a great deal of commerce from there.

Colonel BARDEN. Yes, sir. That is one of the largest cities in the South. I would like to read this report in answer to Senator McNary's question, to show exactly what the Chief of Engineers said about this thing in 1916.

The CHAIRMAN. All right.

Colonel BARDEN. He refers to the report of the district engineer and of the division engineer, and says:

"These reports have been referred, as required by law, to the Board of Engineers for Rivers and Harbors, and attention is invited to its report herewith, dated May 24, 1916. The board states that while the results of the detailed survey and the further studies based thereon suggests some minor modifications in the proposal already before Congress, the report is in all essentials corroborative of the earlier one and presents nothing to change the opinion expressed therein that it is advisable for the United States to take this opportunity of entering into an arrangement with the Muscle Shoals Hydro-Electric Power Co., whereby this serious obstruction to navigation on the Tennessee River will be overcome and at the same time one of the great natural resources of the country will be conserved. The board invites attention, however, to the provisions contained in section 124 of the act to increase the efficiency of the Military Establishment of the United States, approved June 3, 1916, respecting the establishment of nitrate plants to supply Government needs in the manufacture of explosives for military uses, and in view of this legislation it recommends that action on the proposed contract with the Muscle Shoals Hydro-Electric Power Co. be suspended until it has been determined whether the Muscle Shoals power will be utilized for such a nitrate plant. If this question is decided in the negative the board is of opinion that the proposed improvement for combined navigation and power purposes is advisable substantially as proposed by the district officer."

And then the Chief of Engineers says he concurs in the views of the board.

The CHAIRMAN. Of course, that question was decided in the affirmative?

Colonel BARDEN. Yes, sir.

The CHAIRMAN. So the recommendation came to nothing?

Colonel BARDEN. Yes, sir.

The CHAIRMAN. That shows, however, that if we had not made any development at Muscle Shoals, had not started this work, the board was in favor of entering into the arrangement with that private company?

Colonel BARDEN. The board and Chief of Engineers were in favor of this project by which the United States was to contribute $8,575,000.

The CHAIRMAN. Toward the navigability of the river?

Colonel BARDEN. Toward the navigability of the river.

The CHAIRMAN. Is there anything further that any member of the committee wants to inquire about? If not, I think we had better have Major Burns as our next witness.

STATEMENT OF MAJ. J. H. BURNS, UNITED STATES ARMY.

The CHAIRMAN. Major Burns is the officer who has had charge of the chemical work down there. I understand, Major, you have had nothing to do with the navigation questions or the construction of dams?

Major BURNS. No, sir.

The CHAIRMAN. Your work has been entirely in the building of the nitrate plant?

Major BURNS. Yes, sir. I entered the nitrate problem in the summer of 1919, after practically all of the work had been completed, and since that time I have been Chief of the Nitrate Division of the Ordnance Department, which

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has had direct control over the nitrate plants. I am acquainted with the early history through association, but not through direct participation.

The CHAIRMAN. I wish you would go on in your own way, Major, and tell us just what we have there. Just give us a short history of it.

Major BURNS. The Muscle Shoals project is divided into two main parts, the hydroelectric development, that Colonel Barden has just described, and the nitrate or chemical development, that the Ordnance Department has had charge of.

The nitrate project is divided into two plants: United States nitrate plant No. 1, located about a mile southwest from Sheffield, Ala., and nitrate plant No. 2, located about 4 miles northeast of Sheffield, Ala., both on the Tennessee River.

United States nitrate plant No. 2 has, in turn, certain adjuncts, namely, the Waco Quarry, located about 26 miles south of the No. 2 plant, which was constructed for the purpose of insuring a supply of limestone for the manufacture of the product, and the Gorgas power plant, located about 90 miles south of nitrate plant No. 2, which was constructed for the purpose of supplying power for the construction and operation of the nitrate plant. Then there is a transmission line connecting Gorgas with Sheffield, commonly called the Warrior-Muscle Shoals transmission line.

The CHAIRMAN. Major Burns, when you speak of Gorgas, you mean the plant down there?

Major BURNS. Yes, sir; located on the land of the Alabama Power Co.

Senator HEFLIN. On the Warrior River?

Major BURNS. On the Warrior River; yes, sir. The first nitrate plant started was United States nitrate plant No. 1, and the authority for that was the nitrate supply, section 124, of the National defense act of June 3, 1916. After the passage of that act the President and Secretary of War appointed several committees to determine what should be done in order to carry out the provisions of the act, and as a result these committees finally made a report in which they recommended that a plant for the fixation of nitrogen following the synthetic ammonia or Haber process be constructed, with a capacity of about 30 tons of ammonia per day. They also recommended that there be a plant created for the oxidation of a part of this ammonia into a nitric acid, and for the concentration of a part of the nitric acid into a strength of about 94 or 96 per cent.

This general program was followed in the development of nitrate plant No. 1. Construction started in 1917 and was essentially complete at the time of the armistice. There was added to the program of the committee a plant for the manufacture of ammonium nitrate, because of the shortage of explosives that developed during the war. So that the plant as it now stands consists of a synthetic ammonia plant following the general process known as the Haber process, a plant for oxidation of ammonia into nitric acid, a plant for the concentration of nitric acid into a strength of about 94 to 96 per cent, and a plant for the manufacturing of ammonium nitrate from ammonia and nitric acid. It also has extensive housing accommodations for employees and officers who operate the plant, and a steam-power plant with a capacity of about 5,000 kilowatts.

In the operation of the plant a great deal of difficulty was encountered in the synthetic ammonia process, and it was not a success. It was made to work periodically for a few hours at a time, but it always broke down. A really satisfactory plant had not been developed at the time of the armistice. The remainder of the plant, however, was tested out and is successful and can be depended upon to produce its rated capacity.

The CHAIRMAN. Your testimony thus far, major, has been devoted entirely to the one plant there?

Major BURNS. Yes, sir; United States nitrate plant No. 1.

The CHAIRMAN. And that is known as the Haber process?

Major BURNS. Yes, sir. It is a modification of the Haber process, which was developed in the United States by our own chemists.

The CHAIRMAN. To be a little more specific, you say a part of that plant has proven to be a failure? What part of the plant do you refer to?

Major BURNS. It is the plant which has to do with the welding together of nitrogen and hydrogen to form ammonia. That has proven a failure.

The CHAIRMAN. And about what portion of the plant does that constitute?

Major BURNS. In value I should say that it represents approximately one-half of the entire cost.

The CHAIRMAN. Is that of any value now to the Government?

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Major BURNS. If the Government were going to complete the plant and make a synthetic ammonia process plant there it would be of value; yes.

The CHAIRMAN. Have you learned, since the war, or have you more information as to the cause of this failure?

Major BURNS. Yes, sir.

The CHAIRMAN. It could be remedied now if you were building it now, could it not?

Major BURNS. Yes, sir; it could be remedied. This was the pioneer plant in America for the fixation of nitrogen by this process, and it would be almost too much to expect that such a large plant as that could have been satisfactorily designed with the lack of knowledge that existed at the time construction was undertaken. We learned a great deal from the construction and operation of this plant and, as a result of the knowledge gained, the General Chemical Co., in combination with the Semet-Solvay Co., organized the Atmospheric Nitrogen Corporation and constructed at Syracuse, N. Y., a plant which follows the process developed at United States Nitrate Plant No. 1, and it is now in successful operation.

The CHAIRMAN. Was the ignorance of our people who were constructing this plant due to inability to get information from Germany, where it seems this kind of plants were in successful operation prior to this time?

Major BURNS. Yes, sir. I don't think that we knew all of the details of the process as it had been developed in Germany.

The CHAIRMAN. Since the war we have learned the entire process?

Major BURNS. Yes, sir.

The CHAIRMAN. Our people are just as competent as the German chemists are to construct a plant along that line now?

Major BURNS. Yes, sir.

The CHAIRMAN. How much would be the loss in money? How much of this machinery would we have to scrap, and how much would it cost to put this plant in running order up to date?

Major BURNS. In my judgment, practically all of the equipment which is now included in the process building would have to be scrapped and new machinery installed; and, in my judgment, in order to round out the plant to make it capable of producing 30 tons of ammonia per day, which is its rated capacity, would cost approximately $4,000,000. However, some other people state that this estimate is high, but in our general estimate we have allowed a certain amount for tuning up the plant, and making sure that it is workable.

The CHAIRMAN. Now, if this process—the Haber process that you are talking about—could be operated successfully it would be superior to the cyanamid process in the other nitrate plant, would it not?

Major BURNS. In my judgment the possibilities of the Haber process are much greater than are the possibilities of the cyanamid process.

The CHAIRMAN. The cyanamid process requires much more power.

Major BURNS. Yes, sir. It requires 15,000 kilowatts per ton of nitrogen, whereas the Haber process requires only about 4,000 kilowatts per ton nitrogen.

The CHAIRMAN. If you were making explosives by the Haber process at the plant you are now speaking of you would not need this quarry over here, would you?

Major BURNS. No, sir.

The CHAIRMAN. You would not need any limestone that you do need in the cyanamid process?

Major BURNS. No, sir. The raw materials in the Haber process are coke, water, air, and some chemicals to purify the gases and to cause the reactions.

The CHAIRMAN. For the same amount of explosives you would not have near as large an investment as you would in the cyanamid process, would you?

Major BURNS. The capital investment, as far as we know it, is for the Haber process, using the electrolytic hydrogen method $400 per unit, and for the cyanamid process $410 per unit. The unit of capacity is capacity for the production of one ton of ammonia per year. So that the capital investment in the Haber electrolytic is slightly less than the capital investment in the cyanamid process. The capital investment in the Haber water-gas process is about $500 per unit.

The CHAIRMAN. The number of men employed would be less, would it not?

Major BURNS. Yes, sir. The number of men employed would be less. However, the character of the men in the Haber plant would have to be higher, because it involves more complicated manipulations. We have some samples here showing the materials that are used and the materials that are produced.

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Senator McNARY. Are these the same samples you had here about two years ago?

Major BURNS. About the same; yes, sir.

The CHAIRMAN. I want to ask you another question or two about these different processes. Later on, of course, you will take up the cyanamid process that we have there, but at the present time, comparing the two, is it a fact known and understood or at least believed by scientific men, chemists, that great improvements in the way of extracting nitrate from the atmosphere can reasonably be expected if we go into the business?

Major BURNS. Yes, sir. I believe the chemical development will be such that it will probably materially increase the efficiency of nitrogen fixation.

The CHAIRMAN. So as a matter of fact both of these processes, to some extent at least, are experimental at the present time?

Major BURNS. The cyanamid process is pretty well worked out.

The CHAIRMAN. The cyanamid process is the one that requires so much power?

Major BURNS. Yes, sir.

The CHAIRMAN. And you must have cheap power in order to make it in an economical way?

Major BURNS. Yes, sir. While the cyanamid process has been very well worked out, the Haber process is much more in its infancy.

The CHAIRMAN. So we would naturally expect if the Government went into this that probably, as time went on, we would scrap a great deal of the machinery, would we not?

Major BURNS. Yes, sir; evolution would unquestionably require that.

The CHAIRMAN. In fact we would want that to come about?

Major BURNS. Yes, sir.

Senator HEFLIN. Mr. Chairman, I recall when we were at plant No. 1 that Senator McKinley said that a great deal of that machinery could be used for power purposes.

Major BURNS. Perhaps so.

Senator HEFLIN. That it would not have to be junked.

Major BURNS. If you could find a market for it as workable machinery, of course it would be much better.

Senator HEFLIN. Was not that your impression, Senator?

Senator LADD. That is my understanding.

The CHAIRMAN. Major, there is another thing I wish you would make plain to me. So far you have been talking entirely about explosives, and, of course, that was the reason these plants were established, primarily; but, incidentally, and quite important, too, the question of fertilizer arises for the utilization of these plants in time of peace. By either one of these processes that we have there, in order to make fertilizer there would have to be additional machinery added, would there not?

Major BURNS. Yes, sir.

The CHAIRMAN. In other words, the course that is taken in getting the nitrates out of the atmosphere runs along a certain line, and when it has reached a certain point, if you are going to make fertilizer you would go in one direction, and if you were going to make explosives you would go in a different direction?

Major BURNS. That is correct, yes, sir, with this——

The CHAIRMAN. In these plants as we have them now nothing has been done in the way of machinery for the purpose of making fertilizer from the point of diversion, has there?

Major BURNS. No, sir.

The CHAIRMAN. I wanted you to make that plain.

Major BURNS. I want to make this modification of that statement, however——

The CHAIRMAN. How much would it cost now, speaking of this plant, to add the machinery necessary to convert the product into fertilizer instead of explosives?

Major BURNS. You would have to put in an ammonium sulphate plant, which would cost in the neighborhood of three quarters of a million dollars.

Before I get off your point, Senator, I would like to make this statement, that ammonium nitrate, the product of either one of these plants, is a good fertilizer material, an excellent plant food, but it has the unhappy property of absorbing moisture so rapidly that if you put it into a fertilizing machine it

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gums the passages to such an extent that the fertilizer won't flow through the drills. Therefore it is not rated, at present, as a satisfactory fertilizer material.

The CHAIRMAN. And the additional machinery necessary would be machinery necessary to convert it into material that would be a satisfactory fertilizer material?

Major BURNS. It would have to be converted into a more satisfactory material before it could be used as fertilizer.

Senator HEFLIN. In other words, you have manufactured there already some fertilizer ingredients?

Major BURNS. Yes, sir. When you get nitrogen fixed in the form of ammonia you have the base for an excellent fertilizer material.

Senator LADD. Is it not possible that even this ammonium nitrate might be treated in such a way that it would be readily utilizable in a fertilizer?

Major BURNS. Yes, sir. We have been endeavoring to do that very thing for some time with some system of coating with a substance that will not absorb moisture readily.

Senator LADD. What success have you had?

Major BURNS. We have had some, but I would not want to say that we have reached a successful point as yet.

Senator MCNARY. You said the cost would be three-quarters of a million dollars. I don't know whether you finished your answer to the question or not.

Major BURNS. Assuming that the No. 1 plant were a success and were capable of producing to its rated capacity, it would require three-quarters of a million dollars to put in the ammonium sulphate plant that would have to be established to make the product available as fertilizer.

Senator LADD. You already have some sulphuric acid there?

Major BURNS. No, sir; not at that plant. We have at plant No. 2, but not in plant No. 1. I am figuring that this three-quarters of a million dollars would put in the ammonium sulphate plant only and that we would not put in a sulphuric acid plant, but would purchase sulphuric acid from the commercial market.

As I stated before, the raw materials that enter into the final product in the Haber process are air, coke, and water and some chemicals. The first material required is hydrogen, which is to be combined with the nitrogen to form ammonia. Hydrogen is obtained from water gas manufactured, as in all the larger cities of the country, by heating the coke up to white heat and blowing steam through it. As a result the water is broken down into hydrogen and oxygen, and the oxygen, in turn, is combined with the carbon of the coke, and there is obtained a mixture of hydrogen and oxides of carbon. Then the next step is to get nitrogen.

Senator LADD. This first part of the machinery, up to that point, is entirely satisfactory?

Major BURNS. Yes, sir.

Senator LADD. And you will not need any changes?

Major BURNS. No, sir.

Senator HEFLIN. That is at plant No. 1?

Major BURNS. Yes, sir.

Nitrogen is extracted from the air by burning the oxygen out of the air. As a result a mixture of gases is obtained consisting of hydrogen, nitrogen, carbon dioxide, and some other impurities.

The next step is to eliminate everything except the nitrogen and hydrogen, which are the gases to be welded together. This is done by absorbing out the impurities under high pressure. As a result of this purification process there is obtained three parts of hydrogen gas to one part of nitrogen gas in practically a chemically pure state. If they are not in chemically pure state the remaining part of the process can not be satisfactorily performed. The purification of the gases was one of the things that caused much trouble at Muscle Shoals. The purification has to be done under pressure of 100 atmospheres. After the nitrogen and hydrogen are obtained in a purified state, they are brought together at a pressure of 100 atmospheres in the presence of a catalyst and at a temperature of about 600° C. A combination of the two gases ensues, forming ammonia. The catalyst that is used is one of the fundamental features of the process. There seems to be no defined principle at all on which a catalyst works. It seems to be a hit-and-miss proposition. The action of a catalyst is that its presence alone aids in the chemical reaction that takes

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place. In one instance iron might aid a reaction, and in another instance platinum might aid, but nobody can tell except by trying which one is going to give good results.

When we started operation of the plant the catalyst was not satisfactory. While it would combine nitrogen and hydrogen under laboratory conditions, it did not act satisfactorily under the working conditions at the plant.

The rest of the process—i. e., the oxidation of the ammonia to nitric acid, the concentration of the nitric acid, and the production of ammonium nitrate—are all commercial propositions at the present time.

The Ordnance Department feels, as far as the synthetic process is concerned, that its object has been achieved, namely, that there should be constantly in operation at least one plant in the United States which uses the synthetic process. And at the present time the Atmospheric Nitrogen Corporation has a plant in full operation at Syracuse, N. Y.

The CHAIRMAN. Have you been there?

Major BURNS. Yes, sir; I have been there on two occasions.

The CHAIRMAN. What power do they use and what is the capacity of their plant?

Major BURNS. Their plant produces about 10 tons of ammonia per day; about one-third the capacity of the No. 1 plant.

The CHAIRMAN. It is a commercial proposition, of course?

Major BURNS. Yes, sir.

The CHAIRMAN. And what do they sell on the market?

Major BURNS. They sell their product as anhydrous ammonia.

The CHAIRMAN. What is it used for?

Major BURNS. It is used essentially in refrigeration.

The CHAIRMAN. And do they have water power?

Major BURNS. No, sir; they have a steam-power plant.

The CHAIRMAN. Are they able to make that and sell the product on the market at a price that can compete with the product that has sold heretofore?

Major BURNS. There is no doubt in my mind but what they are making a substantial profit on their product. We do not know their real costs, because we never asked to see their books, but the product that they make has a very high value from the standpoint of nitrogen, as they are selling it in the form of anhydrous ammonia, which is quoted at above 25 cents per pound, and our judgment is that it does not cost in excess of 10 to 12 cents a pound to make it.

Senator LADD. That is, with their steam plant?

Major BURNS. Yes, sir.

The CHAIRMAN. That would seem to demonstrate, would it not, Major, that the possibilities of Muscle Shoals with the power that we have there would be something great?

Major BURNS. There is this to remember, Senator: That the anhydrous ammonia market is not great. You can get at least twice as much for that material as you can get for ammonia for manufacturing fertilizer.

Senator LADD. The expense of producing the commercial product there would be somewhat more than that at Muscle Shoals?

Major BURNS. Yes, sir.

Senator LADD. Do you know the exact process used there?

Major BURNS. We do not know all the details, but we do know that they are not using exactly the process we tried out at Sheffield. They have developed a much better process.

Senator HEFLIN. If they can produce by steam at about 10 cents a pound, what would it cost to produce it at Muscle Shoals with water power?

Major BURNS. The amount of power used in the Haber process, especially when you get hydrogen from coke and water, is not very great, and therefore the cost of power does not have any appreciable effect on the cost of your final product. It is different in the case of the cyanamid process, because there the power consumption is much greater.

Senator HEFLIN. The power in the synthetic process, compared with the Haber process, is a comparatively small item?

Major BURNS. Yes, sir; it is about one-quarter. There is this that I would like to point out in reference to the use of power in the synthetic process: As I stated, you can get hydrogen through the reaction of steam on hot coke. When you do that, you do not need much power. You can also get hydrogen by the electroiysis of water; in other words, by running an electric current through cells containing water. If you do that, there is consumed about as much power in the synthethic process as there is in the cyanamid process. In our judg-

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ment, you can produce ammonia by the synthetic electrolytic process as cheaply as you can do it by the cyanamid process, when power costs 4 mills. If power costs less than 4 mills, the cyanamid process is the more expensive; and if power costs more than 4 mills, the cyanamid process is the less expensive of the two.

The CHAIRMAN. Per kilowatt?

Major BURNS. Per kilowatt. With cheap power there is a great possibility of producing cheap ammonia by the synthetic process, using the electrolysis of water.

The CHAIRMAN. They don't use that up there at Syracuse, do they?

Major BURNS. No, sir; because their power would be too expensive.

Senator HEFLIN. Then, Major, I understand that your position is that fertilizers can be produced very much cheaper by water power than by steam power.

Major BURNS. There is no question about that, Senator. The cheaper the power, the cheaper the final product is going to be, because power is one of the big items of expense of production.

Senator HEFLIN. I understand so.

The CHAIRMAN. Were your relations with the Syracuse Co. pleasant in all respects?

Major BURNS. Excellent, sir.

The CHAIRMAN. Were they willing to give you all the information possible?

Major BURNS. Yes, sir; but we took the stand that we would help them all we could and that we did not want them to give us any of their secrets. At the present time the War Department does not expect to proceed with the development of that plant, and sometimes we find that after obtaining the secrets of a corporation it is pretty hard to properly protect them.

The CHAIRMAN. The development of what plant?

Major BURNS. The development of our No. 1 plant.

The CHAIRMAN. Does the War Department think it ought to be abandoned?

Major BURNS. Yes, sir. We believe that our objective has been accomplished, and that it is not necessary to spend more money on the development of that plant. But that is based upon the assumption that it is desired that commercial development take care of the problem rather than the Government.

The CHAIRMAN. The machinery down there will not produce what you started out to produce, will it?

Major BURNS. No, sir.

The CHAIRMAN. They ought at least to protect it and put it in shape. What would be the object of having the Government expend money there unless it would be in such shape that you could produce it in time of war?

Major BURNS. Before we found out that the atmospheric nitrogen process could produce ammonia by the synthetic process we had every intention of developing the plant. We sent a commission over to Europe to find out what was going on there. We established the Fixed Nitrogen Research Laboratory here in Washington to delve into the question and ascertain what the answer was, and we organized a special engineering section to redesign the plant. We found that we could do the work, and in our judgment we could remodel the plant on the smallest scale that would give us commercial knowledge, and operate it for a sufficient length of time to make sure we had a successful process, for about a million and a quarter dollars. About the time we were ready to go ahead the Atmospheric Nitrogen Corporation's plant proved to be successful. We felt that the objective of the Government had been achieved; that there had been developed in America a plant for the fixation of nitrogen by the synthetic process; and therefore we have felt that the Government is not justified in spending a million and a quarter dollars in perfecting——

The CHAIRMAN (interposing). The War Department felt that in case war should break out again they would be able to find the product from commercial companies?

Major BURNS. That is correct; yes sir. We felt that the above company could be relied upon to show, in case of emergency, how to fix nitrogen by the synthetic process.

The CHAIRMAN. It would not be necessary for the Government to make it by that process?

Major BURNS. It would not be necessary for the Government to experiment with that process. Of course, it might be necessary for the Government to make it by that process in case of emergency.

The CHAIRMAN. How would you make it? You would have to have a plant to make it.

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Major BURNS. You would have to construct new plants in time of war, and we would expect to use the knowledge of the Atmospheric Nitrogen Corporation to build these fixation plants.

The CHAIRMAN. Would you be allowed to without paying for it?

Major BURNS. There has never been any question in my mind but what we could use the knowledge of any firm in America for the construction of new plants in time of emergency.

The CHAIRMAN. But you might have to pay the company a big premium.

Major BURNS. That is true.

The CHAIRMAN. And that would be true even though they originally got their knowledge from the Government's experimental plant.

Major BURNS. I would like to point this out: The process we endeavored to install down there was a modification of the Haber process. The General Chemical Co. had already started to develop the process before the Government got into it. That company is the real pioneer in America in the synthetic-process and not the Government. So that we built on their experience, and they in turn built on our experience when they constructed their Syracuse plant.

Senator LADD. Had they originally any other plant than the Syracuse plant?

Major BURNS. Yes, sir. They had a plant, I think, at Laurel Hill, on Long Island, in which they started experimentation.

Senator LADD. And that was not a success?

Major BURNS. It had not progressed very far when the war came on. The Government then took over some of their property in the construction of this nitrate plant No. 1. The General Chemical Co. had not had a chance to try it out thoroughly.

Shall I proceed?

The CHAIRMAN. Are you through with No. 1 now?

Major BURNS. I am, unless there are some further questions.

The CHAIRMAN. All right; go ahead with No. 2.

Major BURNS. Nitrate plant No. 2——

The CHAIRMAN. First, before you leave No. 1, how much has it cost the Government at that plant?

Major BURNS. It cost in round numbers $13,000,000.

Senator HEFLIN. Just one question right there. The chairman asked you a moment ago what would be done with this No. 1 plant; were you going to abandon it or go on and complete it and make it so that it would work satisfactorily? If private enterprise takes over the project, then it can do what it pleases with it—complete it or take it out or put in new machinery?

Major BURNS. Yes, sir. The Ordnance Department has recommended that it be salvaged.

The CHAIRMAN. What would be done with the steam plant there; would that be salvaged?

Major BURNS. Salvage it all; yes, sir.

The CHAIRMAN. The whole thing?

Major BURNS. The whole thing; yes, sir.

The CHAIRMAN. Has the War Department given any consideration to the question of fertilizer manufacture with this plant No. 1?

Major BURNS. No, sir.

The CHAIRMAN. Have you any definitely formed ideas as to what the possibilities might be there if you took the plant and modernized it and equipped it for the manufacture of fertilizer in time of peace as well as explosives in time of war? What are the possibilities?

Major BURNS. I believe that the plant could be made to pay. In other words, I believe it could sustain itself as a fertilizer proposition in time of peace. Of course, in time of war it would be of great value.

Senator LADD. In other words, by an expenditure of two or three million dollars additional you could utilize the $13,000,000 that has already been expended by using more of that plant?

Major BURNS. I think that the capital cost would probably run up to some $4,000,000 in order to make that plant a success, and then you would have to spend year after year the necessary operating expense money, of course. But I think that the returns would be greater than the costs after the plant was well started.

Senator LADD. And the return would be greater from that plant than it would be from the cyanamid plant?

Major BURNS. As I said before, I think that the Haber process has greater possibilities than the cyanamid process.

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The CHAIRMAN. Plant No. 1 down there is much smaller in capacity than plant No. 2?

Major BURNS. Yes, sir.

Senator HEFLIN. Plant No. 1 can be completed by the expenditure of $4,000,000; is that your position?

Major BURNS. Yes, sir; that is correct.

The CHAIRMAN. Of course it is completed now, as far as it could be.

Senator HEFLIN. I mean it could be made so it would work and produce fertilizer?

Major BURNS. Yes, sir.

Senator LADD. In other words, scrapping the machinery that is in the building, utilizing the building, developing and putting in new machinery in that building?

Major BURNS. Yes, sir.

Senator HEFLIN. I understand you to say you could use a great deal of that machinery?

Major BURNS. Personally, I do not think you could use much of the machinery in the process building, but you could use the power plant and gas plant and the process building itself.

Senator HEFLIN. In connection with plant No. 1?

Major BURNS. Yes, sir. You could use a lot of the material that exists down there, but you could not use the special equipment that you used in the process.

Senator HEFLIN. You are talking now about the equipment that belongs to plant No. 1?

Major BURNS. Yes, sir; that is correct.

Senator HEFLIN. By the expenditure of $4,000,000 that could be completed and made to produce fertilizer?

Major BURNS. Yes, sir; that is correct.

The CHAIRMAN. Now, if there are no further questions, take up plant No. 2.

Major BURNS. Plant No. 2 was started in order to relieve the shortage that developed in 1917 in explosives. At that time our only approved explosive was T. N. T. The demand for explosives in warfare was so gigantic that we could not possibly meet the demand with T. N. T., so we cabled to England to find out how they had solved their explosive problem. England sent two experts to us, who stated that England had met its requirements for explosives with amatol, which is a mixture of T. N. T. and ammonium nitrate. Their scheme looked very logical to the War Department and was adopted, but we found that we had a great task in getting ammonium nitrate as well as in getting T. N. T. This was for two reasons—one that we were short of the necessary ammonia, and the other that we were very fearful of the supply of nitrate from Chile with which to produce the necessary nitric acid. So we finally decided to put up this cyanamid plant, which would give us ammonia as well as nitric acid—both from the air. The American Cyanamid Co. had been operating a cyanamid nitrogen fixation plant for several years and were very well equipped to design and operate such a type of fixation plant. So, after considerable negotiation, a contract was entered into between the Government and the American Cyanamid Co. to construct and operate a plant for the Government at Muscle Shoals which would use the only really developed process of nitrogen fixation or the cyanamid process.

The plant consists of a cyanamid plant, a plant for the conversion of cyanamid to ammonia, a plant for the conversion of ammonia into nitric acid, and a plant for the combination of nitric acid with ammonia to form ammonium nitrate. The schedule calls for a capacity of about 110,000 tons of ammonium nitrate per year. The cost of the plant was, in round numbers, $67,000,000.

Senator HEFLIN. Does that take in the cost of the dams, too?

Major BURNS. No, sir; that is just the nitrate plant alone. It does not include Waco Quarry nor Gorgas Power plant nor the transmission line.

The CHAIRMAN. Nor the steam plant?

Major BURNS. Yes, sir. I should have said also that this plant contains a 60,000-kilowatt steam plant.

As an indication of the importance of this plant from a military standpoint, it will fix enough nitrogen to supply constantly some 12 divisions fighting in accordance with the organization in existence at the time of the armistice. When our Army was engaged in the Meuse-Argone offensive, the maximum number of divisions available in the American Army was 30. So No. 2 plant would have been capable of fixing over one-third of the nitrogen required by a force equal to the maximum military effort that America was able to put forth in the World War.

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I will describe the process in very general terms, Mr. Chairman, by comparing the box of samples of the materials of the No. 1 and No. 2 plants.

You see there are more materials entering into the general process than there are into the synthetic process. We start with limestone. That is burnt to form lime, and then lime and coke are combined in the electric furnace to form calcium carbide. That is the same material that is used commercially for the manufacture of acetylene gas.

Senator HEFLIN. Don't you mix the coke and lime wet?

Major BURNS. No, sir.

Senator HEFLIN. You don't mix them wet?

Major BURNS. No, sir. Just mix them in the dry state.

The carbide is finely pulverized so that the nitrogen which we obtain from the air by liquid air process can easily touch every particle of the carbide. Then this nitrogen gas is blown through the carbide, the carbide is heated to a red heat, and the nitrogen is welded to the carbide and lime nitrogen or cyanamid is formed.

Senator HEFLIN. Where was this made, Major?

Major BURNS. That was made down at Nitrate Plant No. 2.

Senator HEFLIN. At Muscle Shoals?

Major BURNS. Yes, sir.

The lime nitrogen is then ground and treated with steam, and ammonia is formed. This is the same product that you have after the first process in Nitro Plant No. 1. Thereafter the ammonia is converted into nitric acid and nitric acid is neutralized with ammonia to form ammonium nitrate in exactly the same way as at the No. 1 plant.

Senator HEFLIN. Were those other ingredients made down there also?

Major BURNS. Yes, sir. We made the ammonia gas, the nitric acid, and the ammonium nitrate all at Muscle Shoals.

Senator HEFLIN. At plant No. 2?

Major BURNS. Yes, sir. This plant was started in the spring of 1918 and was practically complete at the time of the armistice. We were just starting operations at that time. With the armistice it was practically shut down, and then later on it was decided to make a thorough test of the plant to ascertain whether or not we had a real plant. An operating test run was made in the spring of 1919 on the basis of about 20 per cent of capacity, and that run very thoroughly demonstrated that the plant is a complete success and is able to turn out its full quota of satisfactory material. There were some other things that had to be done from a construction standpoint in order to thoroughly complete the plant, and they were done during 1919, and included the completion of the steam power plant at Muscle Shoals and the testing of it, a few improvements on roads, railroads, and things of a similar nature, and also the creation of a quarry plant at Waco Quarry.

The CHAIRMAN. How much railroad do you have in connection with nitrate plant No. 2?

Major BURNS. Thirty-seven miles.

The CHAIRMAN. That is road running out——

Major BURNS (interposing). No, sir; throughout the plant.

The CHAIRMAN. Throughout the plant?

Major BURNS. Service lines.

The CHAIRMAN. How much limestone rock would this plant use per day?

Major BURNS. We quarry about 2,000 tons, which is crushed, and we have left about 1,200 tons of limestone that is satisfactory for the process. The very fine dust from the crusher can not be used in the process.

The CHAIRMAN. That would be a by-product?

Major BURNS. Yes; that would be a by-product. It would probably be used on farms for liming purposes.

The CHAIRMAN. Again, what is the capacity of plant No. 2?

Major BURNS. It produces 110,000 tons of ammonium nitrate per year, or, put into terms of ammonia, it will produce about 150 tons of ammonia per day, or five times what the No. 1 plant will produce.

The CHAIRMAN. And will make all the explosives that our Army needs?

Major BURNS. It will fix enough nitrogen to take care of about 12 divisions using ammunition at about the same rate that the divisions used it during the war.

The CHAIRMAN. Of course, the Army would not be using that much ammunition every day.

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Major BURNS. I am figuring it over a period of time.

The CHAIRMAN. Then it would not supply us with all we needed?

Major BURNS. No, sir: not in a major war.

The CHAIRMAN. Now, you said that it was the idea of the War Department to abandon plant No. 1. Is it the idea to abandon plant No. 2 also?

Major BURNS. No, sir.

The CHAIRMAN. What were you going to do with No. 2?

Major BURNS. The policy with reference to No. 2 is to maintain it in stand-by condition.

The CHAIRMAN. I wish you would say why you want to retain No. 2 and abandon No. 1.

Major BURNS. No. 1 plant will not work to-day and a good deal of additional money would have to be spent on it to make it work. We haven't the money We haven't the $400,000,000 that would be required to make it operate. Commercial companies have developed the process and from a war standpoint we do not believe it is necessary for the Government to develop the synthetic process.

The CHAIRMAN. You would not need No. 2, would you?

Major BURNS. Yes, sir; we would need No. 2. And I will show you why a little later. I will show it to you now if you wish.

The CHAIRMAN. No; I don't want to interfere with your regular plan.

Major BURNS. I will explain to you by means of curves why the No. 2 plant is necessary and why the No. 1 plant is not necessary.

The CHAIRMAN. This will probably be a good time to adjourn.

(Whereupon at 11.55 o'clock p. m. the hearing was adjourned to 10.30 o'clock a. m., Thursday, April 13, 1922.)

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MUSCLE SHOALS.

THURSDAY, APRIL 13, 1922.

UNITED STATES SENATE,
COMMITTEE ON AGRICULTURE AND FORESTRY,
Washington, D. C.

The committee met, pursuant to adjournment, at 10.30 o'clock a. m., in room 224, Senate Office Building, Senator George W. Norris presiding.

Present: Senators Norris (chairman), McKinley, Norbeck, Kendrick, Harrison, and Heflin.

STATEMENT OF MAJ. J. H. BURNS, UNITED STATES ARMY—Resumed.

Major BURNS. Yesterday, Senator, we were discussing United States nitrate plant No. 2.

The prime contractor in the construction of that plant is the Air Nitrates Corporation, which is a subsidiary of the American Cyanamid Co., and there are certain contractual relations still existing between the Government and the Air Nitrates Corporation and the American Cyanamid Co. which are all outlined in the War Department contract called T-66, which, I think, should be inserted in the record.

The CHAIRMAN. Is that the contract between our Government and this contracting company, the Cyanamid Co., or their subsidiary?

Major BURNS. Yes, sir; and there are certain contractual relations with reference to the sale or lease of the plant and with reference to the operation of it from the standpoint of royalties to be paid for the patents owned by the American Cyanamid Co.

The CHAIRMAN. Do you mean to say that if the Government uses that plant to manufacture explosives by that process in time of war they would have to pay a royalty to this corporation?

Major BURNS. Yes, sir; they will have to pay a small royalty in time of war and a larger royalty in time of peace if the plant is operated for the manufacture of fertilizer. It is all outlined in the contract.

Senator KENDRICK. Was not the royalty $8 during the war?

Major BURNS. Yes, sir; approximately $8 a ton of nitrogen fixed; yes, sir.

NOTE.—This should be $12 per ton of nitrogen fixed.

The CHAIRMAN. How much munitions will a ton make?

Major BURNS. A ton of nitrogen would make about 4 or 5 tons of T. N. T., and it would make about the same tonnage of smokeless powder.

The CHAIRMAN. And what about fertilizer?

Major BURNS. A ton of nitrogen would make about 5 tons of ammonium sulphate.

The CHAIRMAN. And ammonium sulphate, 5 tons of that would make how much fertilizer—finished fertilizer to put on the soil?

Major BURNS. It would make about 50 tons.

Senator HEFLIN. That would be about $8 royalty on materials to make 50 tons of fertilizer?

Major BURNS. We are getting on the wrong track. That is the war royalty. The peace royalty is in excess of $8 a ton.

NOTE.—It amounts to $30 per ton of nitrogen fixed.

The CHAIRMAN. Does this contract show what that royalty is?

Major BURNS. Yes, sir; it does. I have not got it clearly in mind just now.

The CHAIRMAN. Then the facts are that the United States Government is not able to make any fertilizer or explosives either to defend itself in time of

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war or feed itself in time of peace, unless it pays this corporation for the privilege of doing it?

Major BURNS. That is correct. We would have to pay a royalty to that company for the use of their processes in this plant.

The CHAIRMAN. Has anybody else any patent on the air that we use?

Major BURNS. Yes, sir. We have a liquid air plant at nitrate plant No. 2, which uses the process of the Air Reduction Co. for the separation of oxygen and nitrogen, and they also are entitled to royalties for the use of their process.

The CHAIRMAN. Either in time of peace or in time of war?

Major BURNS. Yes, sir.

I will put in the record the exact royalties. I do not recollect them now. These royalties are as follows:

Royalty to Air Reduction Co. until January, 1931, is $2.72 per ton of nitrogen fixed as lime nitrogen, after which date there will be no royalty charge payable to the Air Reduction Co. Royalty to the American Cyanamid Co. was to be $12 per ton of nitrogen fixed as lime nitrogen until June 1, 1921. After that date it is $30 per ton of nitrogen content in any and all products manufactured, but this figure, $30, is subject to arbitration.

Royalties and fees.

	Royalty to—	
	Air Reduction Co.	American Cyanamid Co.
Before June 1, 1921:		
Commercial cyanamid	$0.52	$2.30
Nitrate of ammonia	1.16	5.11
Sulphate of ammonia	.59	2.62
After June 1, 1921:		
Commercial cyanamid	.52	5.75
Nitrate of ammonia	1.16	10.39
Sulphate of ammonia	.59	6.18

The CHAIRMAN. Well, then, as a matter of fact the Government can not do anything unless it pays royalties. It can not utilize the air——

Major BURNS. It can not extract nitrogen from the air——

The CHAIRMAN. Without paying some of these corporations for the privilege of doing it?

Major BURNS. It can not extract nitrogen from the air by the Air Reduction Co.'s process without paying royalty to that company for the use of the process which it has developed.

The CHAIRMAN. Now, this process is a patented process?

Major BURNS. Yes, sir.

The CHAIRMAN. Do you know when the patents were issued?

Major BURNS. I believe that the basic patents of the Air Reduction Co. and American Cyanamid Co. expire about 1931.

The CHAIRMAN. Is it not true that out of the investigations made by the Government itself, through its experts, such as yourself, in developing this plant down there, they got additional patents; and have they not been getting patents since the war on this very process?

Major BURNS. Not to my knowledge; no, sir.

The CHAIRMAN. Did the Government make any contract with these people that if there were any improvements made they should have the patent? Do you know about that?

Major BURNS. I do not recollect that right now. I will study the contract, Senator, and I will give you an answer a little later.

NOTE.—The third paragraph of article 8 of the contract applies to this point.

The CHAIRMAN. Have you got the contract separate and apart so that you can put it in the record?

Major BURNS. Yes, sir.

The CHAIRMAN. At this point we will have the contract printed in the record (The contract referred to is as follows:)

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AIR NITRATES CORPORATION AND UNITED STATES OF AMERICA; AMERICAN CYANAMID CO. AND UNITED STATES OF AMERICA—ORDNANCE DEPARTMENT, UNITED STATES ARMY—CONTRACT FOR ERECTION AND OPERATION OF THREE AMMONIUM NITRATE PLANTS AND LICENSE AGREEMENT IN RELATION THERETO, DATED AND EXECUTED JUNE 8, 1918.

This contract, made this 8th day of June, 1918, by and between Air Nitrates Corporation, a corporation organized under the laws of the State of New York (hereinafter called the "agent"), party of the first part, and the United States of America, by Samuel McRoberts, colonel, Ordnance Department, National Army (hereinafter called the "contracting officer"), acting by and under the authority of the Chief of Ordnance, United States Army, and under the direction of the Serretary of War, party of the second part,

Witnesseth: Whereas a state of war exists between the United States of America and the German and Austro-Hungarian Governments, constituting a national emergency, and the United States requires the performance within the shortest possible time of the work hereinafter described; and

Whereas the American Cyanamid Company, a corporation of the State of Maine, is the producer of certain chemicals by the so-called "cyanamid processes" necessary for the production of ammonium nitrate, and is familiar with and controls exclusive patents and processes for the production of such chemicals in this country, and proposes to assist the United States in performing this contract as follows:

1. By licensing the United States and the said Air Nitrates Corporation as agent of the United States to use its patents and processes.

2. By placing at the disposal of the said Air Nitrates Corporation all its experiences, records, and plans appertaining to the production of the said chemicals.

3. By placing at the disposal of the said Air Nitrates Corporation certain members of its executive and technical force for the construction and operation of the plants hereinafter mentioned.

4. By placing at the disposal of the said Air Nitrates Corporation all its plants for the purpose of training superintendents, foremen, and chief operatives.

And the United States proposes to compensate the American Cyanamid Company for the foregoing as set forth in a contract marked "Exhibit 1" bearing even date herewith and annexed hereto; and

Whereas the said company is unwilling to subject its property and assets to liability in connection with the planning, construction, and operation of the proposed plants, and has accordingly organized the Air Nitrates Corporation (the agent under this agreement), which shall act as the agent of and which shall be solely responsible to the United States and others in the planning, construction, and operation of the proposed plants, and according to the terms hereof; and

Whereas the United States entered into a contract with the said Air Nitrates Corporation, under date of November 16, 1917, for the construction and operation, as agent for the United States, at Muscle Shoals, Alabama, of a plant for the manufacture of ammonium nitrate, of an approximate capacity of 110,000 short tons of ammonium nitrate per annum, hereinafter referred to as the Muscle Shoals plant, and work thereon has been commenced; and

Whereas it has now become necessary that two additional plants, each with a capacity of approximately 55,000 short tons of ammonium nitrate per annum, shall be constructed and operated at sites to be selected as hereinafter provided; and

Whereas it is desirable that a new contract be entered into for the construction, completion, and operation of all the said plants of an approximate aggregate capacity of 220,000 tons of ammonium nitrate per annum, such new contract to supersede by mutual consent of the parties hereto and in accordance with the best interests of the United States said contract of November 16, 1917:

Now, therefore, in consideration of the mutual agreements herein contained the said parties have agreed and by these presents do agree with each other as follows:

ARTICLE I.

Exclusive services.—The agent shall engage exclusively in the work of executing this contract, including the designing, constructing, and operating of the plants herein described. It shall use its best endeavors to construct the said

plants as quickly as practicable and at the least possible cost consistent with the proper performance of this contract. This shall include availing itself of the cooperation of the American Cyanamid Company to the full extent contemplated in this contract and the one of even date herewith between the United States and the American Cyanamid Company, hereunto attached and marked "Exhibit 1." The agent will maintain such departments as shall be necessary or appropriate for the carrying out of this agreement, including engineering, administrative, purchasing, construction, manufacturing, inspection, labor relations, workmen's compensation, statistical, commissary, police, fire, medical, housing, accounting, and legal departments.

ARTICLE II.

Muscle Shoals site.—The agent shall, at the cost of the United States, conclude the negotiations heretofore begun for the acquisition by and in the name of the United States of the site on which said plant at Muscle Shoals is now being constructed.

Selection and purchase of sites for new plants.—The agent, acting as agent for and at the cost of the United States, shall forthwith select two sites, each suitable for the construction and operation thereon of plants of the character hereinafter described for the production of ammonium nitrate. After such sites shall have been severally approved in writing by the contracting officer, they shall be secured at the sole cost of the United States and be conveyed to the United States of America by deeds in form and substance satisfactory to the contracting officer, subject only to such liens and incumbrances as the contracting officer shall approve in writing. The deeds shall be properly executed and acknowledged in form for recording in the counties in which the sites are located.

ARTICLE III.

Plans for and construction of plants.—The agent, acting as agent for and at the cost of the United States, agrees—

1. To proceed with and complete the planning, laying out, constructing, erecting, installing, and equipping of the said plant at Muscle Shoals with an approximate capacity as aforesaid, and to furnish all necessary labor, tools, machinery, and materials, and to do all other things necessary or appropriate thereto. All plans and specifications in relation to said plant heretofore approved by or on behalf of the Chief of Ordnance or the contracting officer shall be considered for the purpose of this agreement as having had the approval of the Chief of Ordnance and the contracting officer.

2. To plan, lay out, construct, erect, install, and equip at each of said two new sites a complete plant, with an approximate capacity as aforesaid, for the production of ammonium nitrate, furnishing all necessary labor, tools, machinery, and materials, and doing all other things necessary and appropriate in the premises.

Each of said plants shall include the necessary land; also necessary lime, carbide, nitrogen gas, lime-nitrogen, ammonia, nitric acid, and nitrating plants; also all necessary temporary buildings, houses for employees, administrative buildings, laboratories, shops, warehouses, hospitals, stores, commissaries, structures, lines of communication and transmission, plant machinery, railway and trolley tracks, dredging, docks, boiler plants, roundhouses, roads, ways, waste disposal and sewerage, water and lighting systems, locomotives, cars, fixtures, tools, equipment, apparatus, and appurtenances; also power houses adequate for the development and transmission of such power for the operation of said plants as can not be advantageously obtained through outside sources or agencies; also gravel pits, limestone quarries, coal mines, and other things, to such extent and in such manner as may be reasonably necessary for the prosecution of the work contemplated by this contract; but no coal mine shall be acquired without the written approval of the contracting officer.

ARTICLE IV.

Operation of plants.—The agent, acting as agent for and at the cost of the United States, agrees, as and when any part or parts of said plants are sufficiently completed and ready for operation, forthwith to proceed to operate the same and to continue the operation thereof up to June 1st, 1921, and thereafter

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for so long as the United States shall remain in the present war, subject to the provisions of Article XVII hereof. The agent shall do all things necessary or appropriate in and about the operation of said plants, including the procurement of all necessary labor and power and the purchase of all necessary materials.

Operation under this article shall include placing ammonium nitrate produced hereunder, as from time to time directed, on cars or lighters or in warehouses at the site of the plant where manufactured.

Revenue from housing, etc.—Any revenue, from the operation of any housing, boarding houses, commissary, stores, infirmary, hospital, or other facilities, or from rebates, refunds, etc., shall be accounted for by the agent to the United States.

ARTICLE V.

Materials.—The United States may at any time furnish the agent any materials necessary for use in the performance of this contract.

ARTICLE VI.

Agent to follow directions.—The agent shall from time to time consult with the contracting officer upon the general character of the work contemplated. Upon written request, made from time to time by the contracting officer, the agent shall inform the contracting officer at the earliest practicable time as to any plan, contract, purchase, and method contemplated in the construction and operation of the plants and properties, and the United States may reject, or from time to time require the agent to modify any such plan, contract, purchase or method, or to substitute therefor and carry out such other plans, contracts, purchases, or methods as in the judgment of the contracting officer may be in the interest of the United States, all at the expense of the United States. The agent in the planning, constructing, equipping, and operation of the plants shall abide by such directions as the contracting officer shall from time to time give the agent. All such requests and directions shall be in writing, or by telegraph, addressed to the agent at its address hereinafter stated.

ARTICLE VII.

Specifications.—The processes and work involved in the manufacture of the final product of ammonium nitrate to be produced hereunder shall be conducted so that said final product may be in accordance with such specifications as the Ordnance Department may from time to time adopt for ammonium nitrate to be manufactured under this contract.

ARTICLE VIII.

Processes.—The said plants shall be constructed for operation under the cyanamid process, unless the United States shall direct that some other process be used, in which case all changes in construction thereby necessitated shall be made by the agent at the cost of the United States.

If at any time hereafter in the judgment of the Chief of Ordnance the oxidation of ammonia and its conversion to dilute nitric acid or the manufacture of ammonium nitrate from dilute nitric acid by interaction with ammonia may be done more advantageously by improved methods or processes of persons or companies that the agent, the Chief of Ordnance shall be free to call upon the agent to install and use such methods or processes in its operation of the plants, at the cost and expense of the United States. The Chief of Ordnance shall be free to consult with parties other than the agent upon all matters relating to the operation of the plants, to the end that the best results of operation may be obtained.

The agent shall use its best efforts to make contracts with its employees pursuant to which any inventions relating or applicable to the production of carbide, cyanamid, ammonia, and nitric acid or ammonium nitrate made by such employees while in the service of the agent, shall be protected by United States patents, which patents shall become the property of the Air Nitrates Corporation, subject, however, to the condition that it shall grant to the United States at the time of issue of such patent or patents a nonexclusive license without royalty under each and all of them, such license to be restricted to the United States and to the purchasers of any or all of said plants who may

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receive a license under the provisions of Article X of the agreement of even date herewith between the American Cyanamid Company and the United States. The term "employees" used in this paragraph shall not be deemed to include the persons described in paragraph numbered 3 in Article X hereof.

ARTICLE IX.

Subcontracts.—The agent shall submit to the contracting officer for his written approval, in advance of its execution, any proposed subcontract as to which the contracting officer may direct in writing that his approval be first obtained.

All subconstracts shall contain a reference to this contract and an express provisions that they are subject to all provisions hereof and that they may be assigned by the agent to the United States. Upon request in writing a copy of any subcontract shall be delivered to the contracting officer promptly upon the execution thereof.

ARTICLE X.

Costs and expenses—Audit and payment thereof.—The United States shall bear all costs and expenses of every character and description incurred or made in connection with the planning, construction, equipment, and operation of each of the said plants or any part thereof, and in the conduct of any other business or activities of the agent hereunder; and the United States shall supply all money necessary therefor in such amounts and in such manner as to permit all of the agent's activities with respect to the planning, construction, equipment, and operation of the plants to proceed without delays or interruptions and without the necessity of the agent providing any capital or borrowing any moneys. Vouchers for all accounts payable shall from time to time be furnished to the Chief of Ordnance, and upon presentation of satisfactory evidence he shall either furnish the agent funds to the amounts thereof, which funds shall be immediately paid out by the agent under the supervision of a representative of the Chief of Ordnance, or the vouchers may be paid direct by the Chief of Ordnance to the persons entitled to payment thereunder. Such vouchers shall be acted upon by the Chief of Ordnance promptly.

All accounts payable by the United States hereunder, including those in relation to costs and expenses of construction or operation, shall be subject to audit by the United States, which shall maintain at the plants and elsewhere, if necessary, a sufficient number of auditors promptly to audit the same.

To expedite payments to the agent the United States shall detail representatives at each of the said plants and at the agent's home office, with power and sufficient funds to discharge the pay rolls and to make any other payments as they shall become due hereunder. Payments by the United States shall be subject to correction for errors, if any.

The agent shall make no charge to the United States for the following things:

1. For procuring from the American Cyanamid Company a license to it as agent of the United States to use the said company's patents and processes.

2. For procuring from the American Cyanamid Company the disposal, for purposes of the Air Nitrates Corporation, of the said company's experiences, records, and plans appertaining to the production of the said chemicals hereinabove referred to.

3. For procuring from the American Cyanamid Company the disposal, for the purposes of the Air Nitrates Corporation, of the following members of the said company's executive and technical force, namely: The president, vice president, and general manager, sales and traffic manager, engineering assistant to general manager, superintendent of manufacture, chief technologist, chief engineer, assistant engineer, and, in addition thereto, in connection with the operation of the said plants, two principal works managers, as such offices may from time to time be filled.

4. For procuring from the American Cyanamid Company the disposal, for the purposes of the Air Nitrates Corporation, of all of the said company's plants for the purpose of training superintendents, foremen, and chief operatives.

ARTICLE XI.

Agent's compensation.—As full compensation for the services of the agent the United States shall pay to the agent the following fees:

1. *Construction fee.*—Three and one-third (3⅓) per cent of the cost in connection with the construction and equipment of the said plants, until such cost

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(exclusive of the agent's compensation) shall equal thirty million (30,000,000) dollars, and thereafter one and two-thirds (1⅔) per cent of such cost in excess of said thirty million (30,000,000) dollars. Said fee shall be payable monthly upon that portion of the cost for which payment has been made during the month or months preceding and as to which the fee is unpaid. There shall be credited on account of said construction fee any payments for construction compensation heretofore made to the agent under the provisions of said contract of November 16, 1917. The total of the construction fee shall not exceed one million five hundred thousand (1,500,000) dollars.

2. *Operation fee.*—One-quarter of one cent ($0.0025) per pound of ammonium nitrate produced in compliance with Article VII hereof, and accepted or utilized by the United States, up to and including 110,000 tons produced in any fiscal year of the United States, and one-eighth of one cent ($0.00125) per pound of ammonium nitrate so produced and accepted or utilized in any said fiscal year in excess of such 110,000 tons. Payment shall be made monthly.

The Chief of Ordnance may direct the agent to produce at any one or more of said plants products other than ammonium nitrate, and to the extent that such products are not utilized in the making of ammonium nitrate in any of said plants operated by the agent, the agent shall receive as compensation for making such products an operation fee computed upon such a basis as will give the agent for making such products the same amount as the agent, by way of operation fee, would have received (1) where such products are nitrogenous compounds, for fixing an equivalent amount of nitrogen in the form of ammonium nitrate, and (2) where such products are other than nitrogenous compounds, for making ammonium nitrate equivalent in cost to that of such products.

ARTICLE XII.

Basis of cost for construction fee.—The cost upon which the construction fee of the agent is based shall be the entire cost of the construction of the plants herein mentioned, including, amongst other items, those mentioned in Schedule A, hereto annexed and made a part hereof. The enumeration of said items shall not be deemed to be inclusive of all items of cost and shall not be construed to exclude in determining cost and the fee thereon other items of expenditure entering into the cost of planning, constructing, and equipping the plants not therein enumerated.

ARTICLE XIII.

Maintenance.—The agent shall, at the expense of the United States, maintain the plants in suitable condition for economical operation, and to this end it shall make all proper repairs. The contracting officer may from time to time specify extraordinary repairs, which shall be made only with his written approval. Should any part of any plant be destroyed wholly or partly by fire or otherwise, the Chief of Ordnance shall determine whether such part shall be restored.

ARTICLE XIV.

Title to property.—The title to all property, real or personal, paid for or partly paid for by the United States shall, immediately upon such payment, or upon coming into the possession of the agent, vest forthwith in the United States.

ARTICLE XV.

Records.—The agent shall keep complete records as to all construction and operation expenses, all of which records shall at all times be open to the inspection of the duly authorized representatives of the United States.

Inspection.—The inspection officers of the Ordnance Department shall at all times have full access to the plants for the purpose of inspecting in every detail all work done, materials used, and ammonium nitrate produced, and becoming familiar with all processes and methods used in the manufacture thereof, and the agent shall afford them all necessary facilities and assistance for performing their duties aforesaid.

ARTICLE XVI.

Loss and damage.—The agent in operating, caring for, and storing property shall use all reasonable effort adequately to protect the same, but this shall not authorize or require the agent to take out or carry insurance for this purpose.

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The United States shall hold and save harmless the agent from all loss or damage (exclusive of future profits) by accident, fire, flood, explosion, or otherwise arising or growing out of the construction or operation of the said plants, and all losses and expenses not compensated by insurance or otherwise.

ARTICLE XVII.

Termination of agreement as to any plant.—In the event that, in the opinion of the Chief of Ordnance, the public interests so require, this contract may be terminated as to any or all of the plants described herein by notice in writing to the agent without prejudice to any claim which either of the parties hereto may then have against the other. In the event of the termination of this contract as aforesaid, the United States shall pay to the agent all costs and discharge all obligations of the agent arising in connection with the construction or operation of the said plant or plants theretofore properly incurred, but not previously paid or discharged, as to which said notice is given. At the option of the United States, the agent shall assign or transfer to the United States all contracts outstanding at the date of termination as to any plant previously entered into by the agent hereunder in respect of such plant. In addition thereto the United States shall make the following payments under the following conditions:

(1) In the event that this contract is terminated as aforesaid as to any plant during the construction thereof, if the agent is not in default in any substantial agreement herein contained, the United States shall pay the agent such percentage of the construction fee provided for in Article XI hereof and not theretofore paid as may be found by the Chief of Ordnance as fairly and justly amounting to the precentage of the work then performed, including obligations incurred in respect to said plant, and for which payment has been or will be made.

(2) In the event that this contract is terminated as aforesaid as to any plant during or prior to the operation thereof by the agent, then the agent shall be paid the sum of money, if any, then due on account of the production of ammonium nitrate in said plant, and the United States shall thereafter continue to pay during the period set forth in Article IV hereof to the agent for the ammonium nitrate produced therein one-quarter of one cent ($0.0025) per pound for all ammonium nitrate produced in said plant in any fiscal year of the United States until such date in said year as the amount produced at said plant, together with that produced by the other plants referred to herein, shall equal one hundred and ten thousand (110,000) tons; and as to the amount produced in said plant in said fiscal year, if any there be, after the said one hundred and ten thousand (110,000) tons of ammonium nitrate have been produced as aforesaid, the United States shall pay the agent one-eighth of one cent ($0.00125) per pound. The aggregate payments to the agent under this paragraph (2) on account of plants as to which this contract may have been terminated as aforesaid, shall not exceed five hundred and fifty thousand dollars ($550,000) in any said fiscal year. Wherever the designation ammonium nitrate is used in this paragraph (2), it shall be deemed to include other products, described in paragraph numbered 2 in Article XI hereof, if any there be, produced in the plants described herein, but the fees due on said other products shall be calculated and determined according to the provisions of said paragraph (2) of Article XI hereof.

Provided, however, and it is understood and agreed, that this contract shall not be terminated as to any plant prior to June 1, 1921, or so long as the United States shall remain in the present war, except for the permanent cessation of all activities of the United States in connection with said plant, unless the agent exhibits such default or negligence as respects such plant as to require that the United States in its best interests should directly construct and operate said plant.

In the event of the termination of this contract as to any plant or plants aforesaid, the agent agrees to cooperate with the United States and to give to it its good offices and such assistance as the United States may from time to time request, in making the planning, construction, equipment, and operation of such plants successful and economical in all respects.

ARTICLE XVIII.

Right of United States to discontinue.—Nothing in this contract contained shall be deemed to prevent the United States from at any time discontinuing the construction or operation of any or all of the said plants, and in the event

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of such discontinuance the United States shall be under no liability to the agent for any payments as respects such plant or plants beyond those in this agreement specified. In the event that construction or operation is resumed at any of said plants at which construction or operation has been discontinued, the provisions of this contract shall govern the rights and obligations of the parties with respect to any such plant to the same effect as though the construction or operation thereof had not been discontinued.

ARTICLE XIX.

Sale of plants.—If upon cessation of this war or for any other reason the United States determines to cease the construction, equipment, or operation of any of the said plants and to dispose of the same, the agent shall be given the first opportunity (for a reasonable period of time not to exceed six months after receipt of written notice stating the determination of the United States to dispose of the same, and the material terms upon which such disposition will be made) to purchase the same upon as favorable terms as the United States is willing to accept therefor, before the United States shall sell the same to any other party.

ARTICLE XX.

Bond.—The agent shall furnish to the United States within 20 days after the execution of this agreement a bond in the sum of five hundred thousand (500,000) dollars, conditioned upon the full and faithful performance by the agent of all terms, covenants, and conditions of that part of this agreement providing for the construction of said plants. The surety on said bond and the form thereof shall be satisfactory to the contracting officer. Unless such bond is furnished within said time limit this agreement may, at the option of the contracting officer, be cancelled.

ARTICLE XXI.

Contract nonassignable.—This contract shall not, nor shall any right to receive payment or any other interest therein, be transferred or assigned by the agent to any person, firm, or corporation without the written consent of the Secretary of War.

Disputes.—Except as this contract shall otherwise provide, any doubts or disputes which may arise as to the meaning of anything in this contract shall be referred to the Chief of Ordnance for determination. If, however, the agent shall feel aggrieved at any decision of the Chief of Ordnance upon such reference, he shall have the right to submit the same to the Secretary of War.

Persons not to benefit.—No Member of or Delegate to Congress or Resident Commissioner, nor any person belonging to or employed in the military service of the United States, is or shall be admitted to any share or part of this contract, or to any benefit that may arise therefrom, but this article shall not apply to this contract so far as it may be within the operation or exception of section 116 of the act of Congress approved March 4, 1909 (35 Stat. 1109).

Prison labor.—No persons shall be employed in the performance of this contract who are undergoing sentences of imprisonment at hard labor which have been imposed by the courts of the several States, Territories, or municipalities having criminal jurisdiction.

ARTICLE XXII.

Service of notices.—Any notice addressed to the agent at 511 Fifth Avenue, New York, N. Y., or at such other address as the agent shall by notice in writing advise the contracting officer, and either there delivered or deposited in a postpaid wrapper in any post-office box regularly maintained by the United States, shall be deemed to have been served upon the agent. Nothing herein contained shall preclude service of notices upon the agent by delivery thereof to any of its corporate officers in person.

ARTICLE XXIII.

Prior agreement superseded.—This agreement shall supersede the agreement of November 16, 1917, between Air Nitrates Corporation and the United States, by which Air Nitrates Corporation is authorized to act as agent of the United

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States in the construction and operation of the Muscle Shoals plant hereinbefore referred to.

Provided, however, that such supersession shall not affect any of the rights or obligations of the parties hereto which have accrued or become fixed under said agreement of November 16, 1917, prior to the date hereof, except in so far as it is clearly intended by these presents that such rights or obligations shall be affected, whether through extinguishment, the substitution of others therefor, or otherwise.

Provided, also, that such supersession shall not in any way affect any of the subcontracts, obligations, or commitments which the Air Nitrates Corporation has heretofore in good faith entered into, made, or incurred under said agreement of the 16th of November, 1917.

ARTICLE XXIV.

New contract for deficiency in appropriations.—In the event that the existing appropriations applicable to the purposes of this agreement shall be inadequate, the United States shall have the right to execute and deliver, and the agent shall thereupon also execute and deliver, a new contract having the same terms and conditions as are contained herein.

ARTICLE XXV.

Definitions.—Wherever in this contract the words hereinafter enumerated are used they shall mean what is set opposite them:

Agent: The part of the first part and its duly authorized representatives, successors, and assigns.

Chief of Ordnance: The Chief of Ordnance, the Acting Chief of Ordnance, or any duly authorized representative of either.

Contracting officer: The contracting officer executing this contract, his successor or successors, his or their duly authorized agent or agents, and anyone from time to time designated by the Chief of Ordnance to act as contracting officer.

Ton: Two thousand (2,000) pounds.

Fiscal year of the United States: The period from July 1st in any year to June 30th in the following year, both dates inclusive.

In witness whereof, the parties hereto have caused these presents to be executed and delivered, in triplicate, at Washington, D. C., the day and year first above written.

AIR NITRATES CORPORATION.
By ——— ———,
President.
——— ———,
Secretary.
UNITED STATES OF AMERICA.
By ——— ———,
Col., Ord. Dept., N. A.,
Contracting Officer

SCHEDULE A.

ITEMS OF COST REFERRED TO IN ARTICLE XII.

(*a*) All the land, including gravel pits, quarries, and coal mines, labor, material, machinery, fixtures, equipment, apparatus, appurtenances, tools not owned by the workmen, supplies and equipment necessary for either temporary or permanent use for the construction and operation of the plants, including the opening up and operation of gravel pits, quarries, and coal mines.

(*b*) Rental for construction plants and for the main and branch offices, and for furnishings and equipment for such offices.

(*c*) Loading and unloading construction plant, the transportation thereof, including transportation to and from the place or places where it is to be used in connection with said work, the installation and dismantling thereof and ordinary repairs and replacements during its use in the said work.

(*d*) Transportation and expenses, including transportation tax to and from ork of the necessary field and office forces, procuring labor, and expediting

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the production and transportation of material and equipment. All freight charges on equipment, furnishings, material, and supplies, including transportation tax thereon.

(e) Salaries of managers, engineers, superintendents, timekeepers, accountants, clerks, foremen, and other employees at the main and field offices of the agent in connection with said work, salaries of the executive officers of the agent, except such as shall be placed at the disposal of the agent by the American Cyanamid Company and set forth in said contract marked "Exhibit 1."

(f) Buildings, houses, warehouses, hospitals, infirmaries, stores, commissaries, and structures, and the equipment required therefor and furnishings and equipment required for main and field offices, and the cost of maintaining and operating the same, and including such minor expenses as telegrams, telephone service, expressage, postage, etc.

(g) Buildings of different grades, warehouses, local power plant, structures, plant machinery, railway and trolley tracks, locomotives, cars, roundhouses, roadways, grading and sewerage, water and lighting systems, and fixtures.

(h) All bonds required by this agreement and all bonds necessary or proper, fire, liability, and other insurance, and all losses and expenses not compensated by insurance, which have been actually sustained by the agent in connection with said work. Such losses and expenses, when incurred by the agent in connection with damage to third persons resulting from the work or due to the agent's fault or neglect, shall be included in the cost of the work, but not for the purpose of determining the agent's fee; but such losses and expenses, when incurred by the agent in connection with constructing and replacing any of the work destroyed or damaged, shall be included in the cost of the work for all purposes hereunder.

(i) Permit fees, royalties, and other similar items of expense incidental to the execution of this agreement.

(j) Transportation, including all transportation tax, traveling and hotel expenses, and telephone, telegraph, mail, and express, expenses of officers, engineers, and other employees of the agent as are actually incurred in connection with this work.

(k) Amounts paid to contractors or subcontractors and sums paid by the United States upon contracts made with any person at the request of the agent, and the cost of all materials furnished by the United States.

(l) All manner of expense of the agent in creating and constructing the plants and their equipment, including administration, superintendence, engineering, materials, labor, freights, transportation tax, power, heat, light, rentals, insurance liabilities, losses not covered by insurance and all overhead, general, and legal cost and expense, and including all other items of expenditure made by the agent not properly chargeable to manufacturing.

(m) In addition thereto further allowances, if any there be, of cost as from time to time may be made by the contracting officer.

EXHIBIT I.

LICENSE AGREEMENT.

This agreement entered into this 8th day of June, 1918, between American Cyanamid Company, a corporation organized and existing under and pursuant to the laws of the State of Maine, of the first part, hereinafter called the licensor, and the United States of America, hereinafter called licensee, by Samuel McRoberts, colonel, Ordnance Department, National Army, hereinafter called the contracting officer, acting by and under the authority of the Chief of Ordnance, United States Army, and under the direction of the Secretary of War, of the second part.

Witnesseth: Whereas the licensee has entered into an agreement of even date herewith with Air Nitrates Corporation, a corporation organized and existing under and pursuant to the laws of the State of New York, by which agreement said corporation has agreed as agent of the licensee to construct and operate for the licensee plants for the manufacture of ammonium nitrate, all for the reasons and as is more particularly set forth in said agreement; and

Whereas the licensor possesses certain United States letters patent and is the owner of exclusive licenses under certain other letters patent of the United States, all as set forth in Schedule A hereto annexed and made a part hereof,

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covering certain processes and methods involved in the manufacture of lime nitrogen (calcium cyanamid), its conversion to ammonia gas and the oxidation of ammonia to weak nitric acid, and may grant licenses thereunder; and

Whereas the licensor, to enable said Air Nitrates Corporation to carry out said agreement, will place at the disposal of said corporation its experiences, studies, records, designs, plans, and certain of its executive and technical force, all as hereafter set forth; and

Whereas the licensor entered into a contract with the licensee under date of November 16, 1917, which contract was executed on behalf of the licensee by J. W. Joyes, colonel, Ordnance Department, United States Army, contracting officer, with respect to the license hereinafter granted:

Now, therefore, in consideration of the mutual agreements herein contained, the said parties have agreed, and by these presents do agree, to and with each other as follows, to wit:

ARTICLE I.

License to use certain patented processes, etc.—The licensor, for use and application exclusively by the United States Government of the aforesaid agent at said plants, has given, granted, assigned, and does hereby give, grant, and assign to the licensee the right, license, and privilege to use any and all of the processes, methods, and designs covered by letters patent of the United States and involved in the manufacture of lime nitrogen (calcium cyanamid), its conversion to ammonia gas and the oxidation of the ammonia to weak nitric acid, which said letters patent are described in Schedule A, annexed hereto and made a part hereof, for and during the time the United States shall remain in the present war, and in any event until June 1, 1921, together with all improvements therein and all patents or other rights relating thereto which the licensor may hereafter make or secure during said period.

The licensor agrees that nothing contained in this agreement shall restrict the licensee to the use only of such rights and patents, as the licensor now possesses or may hereafter possess, and the licensee has the privilege of using the processes, rights, and patents of persons other than the licensor, either in conjunction with the processes, rights, and patents of the licensor or independent thereof, if in the judgment of the contracting officer such action is required to obtain the best results of operation.

ARTICLE II.

Use of licensor's experiences, records, etc.—The licensor agrees to place at the disposal of the said Air Nitrates Corporation and the contracting officer, for the production of ammonium nitrate and the construction and operation of the plants referred to in the agreement between the licensee and the Air Nitrates Corporation above referred to, all the experiences, records, studies, designs, and plans of the licensor bearing on and pertaining to the processes necessary or incidental to the manufacture of ammonium nitrate now owned by the licensor, and agrees that the said Air Nitrates Corporation and its representatives and the contracting officer shall have access to said experiences, records, studies, designs, and plans at all reasonable hours and shall be permitted to make copies thereof and excerpts therefrom. The licensor further agrees to divulge to the said Air Nitrates Corporation and the contracting officer for the sole purpose of this agreement and said agreement between Air Nitrates Corporation and said licensee, all of the secret processes which, combined with the processes covered by the aforesaid letters patent, go to make up the system of manufacture of ammonium nitrate.

ARTICLE III.

Use of licensor's plants for training purposes.—The licensor agrees to place at the disposal of the said Air Nitrates Corporation and the contracting officer all of the plants now owned or operated by the licensor for the purpose of training of superintendents, foremen, chief operatives, and the like for the proposed plants to be constructed and operated by the Air Nitrates Corporation, and further agrees that the said corporation and its representatives and the contracting officer shall have access to said plants at all reasonable hours for the purpose above referred to.

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ARTICLE IV.

Services of certain of licensor's technical men.—The licensor agrees to place at the disposal of the said Air Nitrates Corporation for the construction and operation of the plants under the contract above referred to the following members of the executive and technical forces of the licensor as from time to time constituted, namely, president, vice president and general manager, engineering assistant to general manager, superintendent of manufacturing, sales and traffic manager, chief technologist, chief engineer, assistant engineer, and, in addition thereto, in connection with the operation of said plants, two principal works managers; and further agrees to pay the entire salaries of such persons during the terms of said agreement between the licensee and said corporation, and agrees that at all times it will maintain an executive and technical force which shall be familiar with the operation of the processes involved in the manufacture of ammonium nitrate.

ARTICLE V.

Benefit hereunder to accrue to Air Nitrates Corporation.—The licensor agrees that all of the benefits to accrue to the licensee by the terms of this agreement may be at any time assigned to the Air Nitrates Corporation and shall in any event accrue to the Air Nitrates Corporation, but only for the purposes of said agreement between the United States and the Air Nitrates Corporation. The licensor shall have the right to grant, and at the written request of the licensee will grant, a license in all respects similar to the license herein granted to the Air Nitrates Corporation to enable said corporation to carry out its agreement with the United States of even date herewith.

ARTICLE VI.

Royalty.—In consideration of the granting of the license provided for in Article I hereof and of the other conditions to be performed by the licensor, the licensee agrees to pay the licensor during the term thereof specified in said article, as royalty, an amount equivalent to six mills ($0.006) per pound of all nitrogen fixed as lime nitrogen manufactured at the plants hereinbefore described in the contract of even date herewith between the United States and the Air Nitrates Corporation, and to which reference has hereinbefore been made, up to and including the first ninety-one million seven hundred thousand (91,700,000) pounds of such nitrogen so fixed in any fiscal year of the United States, and in addition thereto three mills ($0.003) per pound of all nitrogen fixed as lime nitrogen in any said fiscal year in excess of the said ninety-one million seven hundred thousand (91,700,000) pounds of nitrogen, it being further understood and agreed that no part of such royalty shall directly or indirectly inure to the benefit of an alien enemy of the United States except as may appear upon a disclosure of stock lists made pursuant to law. Payment for royalties shall be made each month as early in the month as practicable upon the presentation of satisfactory evidence showing the production during the preceding month of nitrogen fixed as lime nitrogen at the plants hereinbefore referred to.

ARTICLE VII.

Acknowledgment of ownership of patents, processes, etc.—It is understood and agreed that so far as the right, license, and privilege to use any and all of the patents, processes, methods, and designs, as described in Schedule A hereto annexed, is given, granted, and assigned hereby, the Government and its agents and other parties claiming under this license, do and they shall acknowledge and recognize the American Cyanamid Company as the sole owner of said patents, processes, methods, and designs and of the exclusive right to use the same, subject only to the rights granted to the United States by this license and any license granted said Air Nitrates Corporation, and the United States shall, so far as practicable, exclude the public from all works in which said processes shall be employed, and generally shall use all reasonable means to preserve said rights unimpaired.

ARTICLE VIII.

Indemnity against infringement.—To the extent only that the licensor shall have received cash hereunder the licensor agrees to defend and save harmless the Air Nitrates Corporation and the United States from all suits and claims

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for infringement by reason of the use by either of them of its patents for the making of cyanamid and the making of ammonia gas, which said patents are described in Schedule B hereto annexed and made a part hereof, and pay any judgments which may be obtained therefor against the licensee or the said Air Nitrates Corporation, but only to the extent aforesaid.

The licensor will defend and save harmless the licensee and the Air Nitrates Corporation from any action or suit brought by any person in privity with it in which the right of said licensee or said corporation to use said patents described in said Schedule A shall be attacked: *Provided, however*, That the United States shall promptly give the licensor written notice of any and all such suits, actions, or claims described in this article and tender the defense thereof to the licensor.

ARTICLE IX.

Termination of agreement as to any plant.—In the event that the United States shall terminate this agreement as to any one or more of the plants to be constructed by the Air Nitrates Corporation under said agreement of even date herewith and pursuant to the provisions in that behalf therein contained, all of the rights and privileges herein inuring to the said Air Nitrates Corporation shall inure in respect of the plant or plants as to which said agreement is terminated, to the benefit of the United States, but only until June 1, 1921, and so long thereafter as the United States shall remain in the present war.

ARTICLE X.

License to use patents, processes, etc., after 1921 or the end of the war; arbitration of royalties thereunder.—The licensor hereby gives and grants to the licensee, in addition, for use and application exclusively by the licensee in the operation of the aforesaid plants, the right, license, and privilege to use any and all of the patents, processes, methods, and designs embraced in the license hereinbefore granted to the licensee by Article I hereof, from and after the first day of June, 1921, or the date upon which the United States shall cease to be in the present war (whichever date shall last occur) and until the expiration of the United States patents covering the same, upon the following terms, to wit:

The licensee shall pay monthly to the licensor for such additional license under this article a royalty, unless and until changed by the arbitration hereinafter provided, of one and one-half cents ($0.015) per pound of nitrogen content in any and all products manufactured by the licensee at each and every of said plants under and by the use of any of the patents, processes, methods, or designs embraced in the said additional license.

In the event that either the licensor or the licensee shall be dissatisfied with the aforesaid royalty in this article defined, either or both may, within the first three years of the period fixed for the duration of said additional license, demand that the amount of the royalty to be paid hereunder shall be determined and fixed by arbitration. Such demand shall be made in writing and shall be delivered to the other party hereto, together with the name and address of the arbitrator chosen by the party demanding the arbitration, and the other party hereto shall, within fifteen (15) days thereafter, choose a second arbitrator and notify the party demanding the arbitration of its choice and give the name and address of such arbitrator. The two arbitrators so chosen shall, within fifteen (15) days after being notified by either party that the second arbitrator has been chosen, choose a third arbitrator. The arbitrators, when chosen, shall promptly fix a time and place for the hearing, and then and there the parties hereto shall attend and present their respective proofs and arguments. The hearing may from time to time be adjourned by the arbitrators by a writing notifying the parties of the time and place to which such adjournment is made.

The arbitrators shall with all reasonable speed ascertain and determine what, in their opinion, under all the circumstances, are adequate and reasonable royalties to be paid under this article and the date, not earlier than that of the demand for such arbitration, from which the said award shall be effective. They shall notify the parties in writing of the royalties so ascertained and determined and state the amount, if any, that either party may then owe to the other with respect to royalties under the terms of the award. The said award when signed by any two of the arbitrators shall be final and conclusive upon all parties concerned.

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In the event that either the second or the third arbitrator shall not be chosen in the manner and within the time hereinabove fixed, any United States district judge for the Southern District of the State of New York, upon the application of either party, may choose an arbitrator or arbitrators, as the case may be, to act.

No terms with respect to royalty contained in this agreement or in the said agreement of November 16, 1917, or in any agreement between said Air Nitrates Corporation and the United States, or in any negotiations or proposals between the said several parties looking to the making of the said agreements or relating to the subject matter thereof shall be utilized by either party in said arbitration or taken into consideration by the arbitrators in making their award.

The costs and expenses of the arbitrators and of the arbitration shall be ascertained by the arbitrators and shall be borne equally by the parties hereto.

The licensee may transfer to the purchaser of any one or more of said plants the right to avail itself of the license in this article granted in the operation of the plant or plants so purchased, if said purchaser, as a term of said purchase, expressly covenants to undertake, observe, and perform all the terms of this article, including the payment of royalties and the findings of the said arbitrators, if any, as respects the plant or plants so purchased.

ARTICLE XI.

Cessation of royalties.—If the use of the inventions of the aforesaid letters patent and the methods, apparatus, and processes owned by the licensor and disclosed hereunder to the Air Nitrates Corporation and the licensee shall be discontinued by the Air Nitrates Corporation or by the licensee or its assigns, the obligation for the payment of royalties hereunder shall cease as to those of said parties who shall have so discontinued such use.

ARTICLE XII.

Contract not assignable.—This contract shall not, nor shall any right to receive payment, or any other interest herein, be transferred or assigned by the licensor to any persons, firms, or corporations.

ARTICLE XIII.

Persons not to benefit.—No Member of or Delegate to Congress, or Resident Commissioner, is or shall be admitted to any share or part of this contract or to any benefit that may arise therefrom, but this article shall not apply to this contract so far as it may be within the operation or exception of section 116 of the act of Congress approved March 4, 1909 (35 Stat. 1109).

ARTICLE XIV.

Disputes.—Except as this contract shall otherwise provide, any doubts or disputes which may arise as to the meaning of anything in this contract shall be referred to the Chief of Ordnance for determination. If, however, the licensor shall feel aggrieved at any decision of the Chief of Ordnance upon such reference, he shall have the right to submit the same to the Secretary of War.

ARTICLE XV.

Definitions.—Whenever in this contract the words hereinafter enumerated are used they shall mean what is set opposite them.

Licensor: The party of the first part and its legal representatives, successors, and assigns.

Chief of Ordnance: The Chief of Ordnance, the Acting Chief of Ordnance, or any duly authorized representative of either.

Contracting officer: The contracting officer executing this contract, his successor or successors, his or their duly authorized agent or agents, and anyone from time to time designated by the Chief of Ordnance to act as contracting officer.

ARTICLE XVI.

New contract for deficiency in appropriations.—This agreement shall be binding upon the licensor for the term of the license, but in the event of the existing appropriations applicable to the purposes of this contract being inade-

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quate, the licensee shall have the right to execute and deliver, and the licensor shall thereupon also execute and deliver a new contract having the same terms and conditions as are contained herein.

ARTICLE XVII.

Previous agreement superseded.—This agreement shall supersede the said agreement of November 16, 1917, between the licensor and the licensee.

In witness whereof, the parties hereto have caused this contract to be executed in triplicate, at Washington, D. C., the day and year first above written.

AMERICAN CYANAMID COMPANY,
Licensor.

By ——— ———,
President.

Attest:

———— ————,
Secretary.

UNITED STATES OF AMERICA,

By ——— ———,
Colonel, Ordnance Dept., N. A., Contracting Officer.

SCHEDULE A.

[Being a part of license agreement hereto annexed.]

LIST OF PATENTS COVERING PROCESSES AND PRODUCTS OF THE PROPOSED GOVERNMENT NITRATE PLANTS.

U. S. Patent 776314. "Process of Making Ammonia," November 29, 1904.
U. S. Patent 785161. "Process of Making Nitrogen Compounds," March 21, 1905.
U. S. Patent 12762. "Process of Making Nitrogen Compounds," March 10, 1908.
U. S. Patent 996011. "Method of Making Nitrogen Compounds," June 20, 1911.
U. S. Patent 999071. "Apparatus for Producing Calcium Cyanamid," July 25, 1911.
U. S. Patent 1009705. "Process of Making Calcium Cyanamid," November 21, 1911.
U. S. Patent 987674. "Process of Producing Nitrogen Compounds," March 21, 1911.
U. S. Patent 1006927. "Method of Producing Nitrogen Compounds from Carbids," October 24, 1911.
U. S. Patent 1010404. "Apparatus for Producing Nitrogen Compounds from Carbids," November 28, 1911.
U. S. Patent 1100582. "Process of Crushing and Grinding Calcium Carbid," June 16, 1914.
U. S. Patent 1100539. "Cyclical Process of Fixing Atmospheric Nitrogen," June 16, 1914.
U. S. Patent 1103060. "Method and Means for Fixing Nitrogen," July 14, 1914.
U. S. Patent 1103061. "Process and Apparatus for Fixing Atmospheric Nitrogen," July 14, 1914.
U. S. Patent 1103062. "Method of and Apparatus for Fixing Nitrogen," July 14, 1914.
U. S. Patent 1149653. "Process of Making Ammonia from Calcium Cyanamid," August 10, 1915.
U. S. Patent 1183885. "Apparatus for Producing Ammonia," May 23, 1916.
U. S. Patent 1154640. "Process of Producing Ammonia," September 28, 1915.
U. S. Patent 1163095. "Process of Making Ammonia from Calcium Cyanamid," December 7, 1915.
U. S. Patent 1242953. "Process for Producing Nitrose Gases," October 16, 1917.
U. S. Patent 1193796. "Method of Oxidizing Ammonia," August 8, 1916.

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U. S. Patent 1193797. "Process of and Apparatus for Oxidizing Ammonia," August 8, 1916.
U. S. Patent 1193798. "Catalyzer Apparatus for Oxidizing Ammonia," August 8, 1916.
U. S. Patent 1193799. "Platinum Catalyzer," August 8, 1916.
U. S. Patent 1193800. "Catalyzer for Oxidizing Ammonia," August 8, 1916.
U. S. Patent 1206062. "Process of Making Nitric Acid and other Products," November 28, 1916.
U. S. Patent 1217247. "Process of Making Ammonia Nitrate and other Products," February 27, 1917.
U. S. Patent 1206063. "Process of Making Nitric Acid and other Products," November 28, 1916.

SCHEDULE B.

[Being a part of license agreement hereto annexed.]

U. S. Patent 776314. "Process of Making Ammonia," November 29, 1904.
U. S. Patent 785161. "Process of Making Nitrogen Compounds," March 21, 1905.
U. S. Reissue 12762. "Process of Making Nitrogen Compounds," March 10, 1908.
U. S. Patent 996011. "Method of Making Nitrogen Compounds," June 20, 1911.
U. S. Patent 999071. "Apparatus for Producing Calcium Cyanamid," July 25, 1911.
U. S. Patent 1009705. "Process of Making Calcium Cyanamid," November 21, 1911.
U. S. Patent 987674. "Process of Producing Nitrogen Compounds," March 21, 1911.
U. S. Patent 1006927. "Method of Producing Nitrogen Compounds from Carbids," October 24, 1911.
U. S. Patent 1010404. "Apparatus for Producing Nitrogen Compounds from Carbids," November 28, 1911.
U. S. Patent 1100582. "Process of Crushing and Grinding Calcium Carbid," June 16, 1914.
U. S. Patent 1100539. "Cyclical Process of Fixing Atmospheric Nitrogen," June 16, 1914.
U. S. Patent 1103060. "Method and Means for Fixing Nitrogen," July 14, 1914.
U. S. Patent 1103061. "Process and Apparatus for Fixing Atmospheric Nitrogen," July 14, 1914.
U. S. Patent 1103062. "Method of and Apparatus for Fixing Nitrogen," July 14, 1914.
U. S. Patent 1149653. "Process of Making Ammonia from Calcium Cyanamid," August 10, 1915.
U. S. Patent 1183885. "Apparatus for Producing Ammonia," May 23, 1916.
U. S. Patent 1154640. "Process of Producing Ammonia," September 28, 1915.
U. S. Patent 1163095. "Process of Making Ammonia from Calcium Cyanamid," December 7, 1915.

Major BURNS. There is also a proviso in the contract with reference to sale of the plant which is quite pertinent and which I think should be read.

The CHAIRMAN. What about that? Has the Government tied itself up so we could not sell the property?

Major BURNS. I will read you the proviso, Senator.

The CHAIRMAN. All right; read it.

Major BURNS. It is article 19, "Sale of plants."

"If upon cessation of this war, or for any other reason, the United States determines to cease the construction, equipment, or operation of any of the said plants and to dispose of the same, the agent shall be given the first opportunity (for a reasonable period of time, not to exceed six months after receipt of written notice stating the determination of the United States to dispose of the same, and the material terms upon which such disposition shall be made) to purchase the same upon as favorable terms as the United States is willing to accept therefor, before the United States shall sell the same to any other party."

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In other words, if the Government determines to sell this plant it must state to the Air Nitrate Corporation the price at which they are willing to sell it, and the Air Nitrate Corporation has the option of purchasing it within six months at that price.

Senator HEFLIN. Is the American Cyanamid Co. a foreign corporation?

Major BURNS. No; it is an American corporation.

Senator HEFLIN. I mean it is owned by foreign stock; the stockholders are principally foreigners?

Major BURNS. I don't think so. It is called the American Cyanamid Co., and I think the great bulk of its stock is owned in America. It does, however, run a plant in Niagara Falls, Canada.

Senator KENDRICK. I was just going to ask is it not a Canadian-owned corporation?

Major BURNS. Not to my knowledge, Senator. I think it is essentially an American-owned corporation.

Senator HEFFLIN. I have see the statement to that effect—that it is owned principally by people who are not Americans.

Major BURNS. Well, I will check up on that and give the data that I can for the record.

Senator HEFLIN. I wish you would.

(This point was covered in the hearings before the Senate Committee on Agriculture and Forestry, 66th Cong., 2d sess., on bill S. 3390, p. 238, when the following questions and answers were made:)

"The CHAIRMAN. Some of the stock of the American Cyanamid Co., as I understand it, is owned by foreign capital?

"Mr. WASHBURN. Yes.

"The CHAIRMAN. Is the majority of the stock owned by American citizens?

"Mr. WASHBURN. Oh, yes; about 70 per cent—well, more than 70. We will say 75 per cent is owned here and 25 per cent abroad."

Major BURNS. I might say that the question of the legality of this article of the contract with the Air Nitrates Corporation has been passed upon by the Judge Advocate General of the Army, and he claims that it is null and void.

The CHAIRMAN. Yes; but does that apply, that judgment of the Judge Advocate, to that one article or to the whole contract?

Major BURNS. Just to that one article, sir.

The CHAIRMAN. The contract outside of that is legal?

Major BURNS. We did not ask him for an opinion upon the legality of the entire contract. We only asked him for an opinion on this article, and he said it is null and void.

Senator KENDRICK. Major, is not that a very liberal contract compared to what the American Cyanamid Co. asked from the Government when they first proposed to give them the use of their organization and the opportunity to use their patents?

Major BURNS Do you mean is this a more liberal contract than they originally asked for?

Senator KENDRICK. Yes. My recollection is that their proposition to the Government was that they would furnish them the use of their organization, the Government paying all of the expenses, for a million dollars a year, and $8 a ton royalty on the amount of product, and the final delivery to the American Cyanamid Co. of the entire plant when the war ended, in fee simple.

Major BURNS. Of course this contract was the subject of considerable negotiation between the officers and special representatives of the Government and the American Cyanamid Co.

Senator KENDRICK. I think that is a matter of record. I think that their proposition, that I have stated, is a matter of record.

The CHAIRMAN. There was no such contract, Senator, was there?

Senator KENDRICK. No; but then it was their original proposition to the Government.

The CHAIRMAN. Well, that was very liberal of them, if they didn't include the Capital of the United States to be turned over to them.

Senator KENDRICK. Well, I asked the witness if that proposition were made in a spirit of patriotism to help out in the war?

The CHAIRMAN. I suppose it was.

Senator HEFLIN. And then at the end of the war to take it back so that we would not have any way to provide ourselves with nitrates in case of another war?

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The CHAIRMAN. We could buy it. We could tax ourselves to give them some more money to do that in the next war, all right. But the contract, Senator, says that we ought to give them the whole thing. It does not relinquish anything.

Senator HEFLIN. What inducement, if anything, Major, did they offer to the Government in order to sign a contract like that?

Major BURNS. Of course it was their knowledge and organization that permitted of the construction of this plant. Without them we could have done nothing. We had no knowledge of our own.

The CHAIRMAN. Of course it was the Government's patent, however, that gave them everything that they had. If it had not been for the patent they received from the Government, giving them a monopoly on this business, they would not have had anything either.

Major BURNS. There is no doubt but what the Government patent protected their business.

The CHAIRMAN. Yes; and that was used in the next round to take advantage of the Government. The Government, though, gave this patent that enabled them in turn to hold up the Government, if they are held up.

Major BURNS. I do not know as to the fairness of the contract.

I feel, though, that I should say this with with reference to the prime contractor, or Air Nitrate Corporation, in my judgment they did an excellent job. I think they turned out a plant that is a credit to themselves and to America, aside from the compensation which they received for it.

The CHAIRMAN. Well, they were paid for it, were the not?

Major BURNS. Yes, sir.

The CHAIRMAN. How much were they paid?

Major BURNS. They would have received, in accordance with their contract for the construction of nitrate plant No. 2 and the two other cyanamid plants which were started during the war, nitrate plants Nos. 3 and 4, a fee of $1,500,000, but the Government has never paid them but approximately $1,150,000. The Government has held up the balance of the fee because the director——

The CHAIRMAN. The fee was just a bonus that the Government paid for the plant outside of that, did it not?

Major BURNS. The Government paid all the expenses and would have given the company, if the contract had been carried out as written, a fee, as profit to the company for the work it did, of $1,500,000.

Senator HEFLIN. Why did the Government stop paying that?

Major BURNS. Because the director of construction of nitrate plants, Mr. Cranford, who was placed in charge of the work by the Government, thought that a fee of $1,150,000 was all that the work was worth, and he refused to pay the balance.

The CHAIRMAN. Now, Major, this contract, as I understand it, provides that the contractor shall be paid a royalty?

Major BURNS. That is correct.

The CHAIRMAN. If the Government makes anything it will pay $12 a ton for everything it makes there?

Major BURNS. $12 per ton in time of war, and $30 in time of peace.

The CHAIRMAN. So that their fee consists not only in a royalty, but it consists in a continued royalty as long as these plants are operated by the Government?

Major BURNS. Yes, sir. For the life of the patents.

The CHAIRMAN. And is not that price going to be prohibitive and really prevent the Government from making a fertilizer at a price that the farmer can afford to buy it for?

Major BURNS. No, sir; I do not think so, for the reason that there is a clause in the license agreement which allows either party to have the question of royalties submitted to a board of arbitration in order to determine the fairness of the royalty; and, in my judgment, that board of arbitration would determine upon a fair royalty and one that would allow the plant to live if it had a chance, under normal economic conditions.

Senator KENDRICK. Major, as I understand your statement about the character of the plant when it is finished, it represents a very different proposition from the Haber process?

Major BURNS. Yes, sir; it is entirely different.

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Senator KENDRICK. In fact, this plant when completed would give efficient service, while the other one was completed in so far as every appearance went, and it would not produce?

Major BURNS. That is correct.

The CHAIRMAN. The American Cyanamid Co. had nothing to do with the Haber process?

Major BURNS. No, sir.

The CHAIRMAN. That is an entirely different thing?

Major BURNS. Yes, sir.

The CHAIRMAN. You are not handicapped in that plant, if you can make it work, by having to pay a royalty or giving them anything.

Major BURNS. Yes, sir. We have a royalty on the process of plant No. 1 with the General Chemical Co.

The CHAIRMAN. How did that happen to get in there?

Major BURNS. Because it was their process that the Government adopted.

The CHAIRMAN. But the process adopted did not work and never has worked.

Major BURNS. It did not work; no, sir. As to whether that royalty agreement would be binding, I don't know.

The CHAIRMAN. Is there an agreement with the General Chemical Co.?

Major BURNS. Yes, sir.

The CHAIRMAN. That in that other plant we are going to pay them a royalty, too?

Major BURNS. Yes, sir.

The CHAIRMAN. For making fertilizer?

Major BURNS. Yes, sir.

Senator KENDRICK. Senator Norris, that is exactly what I was bringing out a moment ago, that one operates successfully and the other does not. Whether they would be entitled to a royalty——

The CHAIRMAN. In both cases the Government did it all. They didn't do anything.

Senator HEFLIN. The Government furnished all the money?

The CHAIRMAN. Yes.

Senator KENDRICK. Yes; but I take it that each company, the owner of each one of these processes, supervised the building of the plants.

The CHAIRMAN. Yes; and got paid for it. They have not any more claim on it than the carpenter who ran a plane that planed off the doors.

Senator KENDRICK. I understand that fully, but one company furnished a process that worked, and the other one furnished a process that did not work. Is not that true?

Major BURNS. That is correct; yes, sir.

Senator HEFLIN. Now, then, Major, under that contract the Government is compelled to permit this American Cyanamid Co. to have the first opportunity to buy this whole proposition down there?

Major BURNS. That is the intent of the contract; yes, sir.

The CHAIRMAN. That is the Cyanamid Co., Senator.

Major BURNS. Yes, sir; that is No. 2 plant.

Senator HEFLIN. Now, if somebody else buys this plant they have got to pay royalties to the American Cyanamid Co. on their product turned out there until 1931?

Major BURNS. Yes, sir; that is correct; and they would have to pay the stipulated royalties in the contract or have the royalty matter submitted to the board of arbitration and an adjustment secured.

Senator HEFLIN. Has not the Judge Advocate General of the Army rendered some opinion on this case in which he says that that contract is not binding on the Government?

Major BURNS. Not to my knowledge. He has never rendered an opinion to the effect that the whole contract is not binding. He has rendered a decision to the effect that the article which I read which pertains to the option to purchase is not binding on the Government.

Senator HEFLIN. That feature of it?

Major BURNS. Yes, sir. He claims that the Government has a right to sell this plant to anybody that it sees fit to sell it to.

Senator KENDRICK. Major, you stated a moment ago, as I understood you, that the Government would also be required to pay a royalty to the Haber people; that is, to the General Chemical Co.?

Major BURNS. The General Chemical Co.; yes, sir.

Senator KENDRICK. The General Chemical Co. Do you recall what the amount of that royalty is?

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Major BURNS. Yes, sir; it is $5 per ton of fixed nitrogen.
Senator KENDRICK. The other was $12?
Major BURNS. Yes, sir.
The CHAIRMAN. What is that provision in the contract?
Major BURNS. I will read that clause. Perhaps that will be the best answer to the question.
The CHAIRMAN. All right.
Major BURNS (reading):
"In so far as the Government shall see fit to employ said processes or apparatus or any of them in the manufacture of products to be used exclusively for munitions of war, no compensation by way of royalty or otherwise will be asked or received by the General Chemical Co.
"In so far as the Government shall see fit to employ the said processes or apparatus or any of them, in the manufacture of products to be used for fertilizers, the Government shall pay to the General Chemical Co. a royalty for such use. The royalty so to be paid shall be based upon the nitrogen content of the material produced for fertilizer purposes and shall be at the rate of $5 for each ton of 2,000 pounds of fixed nitrogen in whatever form combined, and shall be payable quarterly until the 9th day of November, 1932, and thereafter until the expiration of all patents involving any substantial feature of the process or apparatus."
Now, I stated that we had to pay a royalty to the General Chemical Co. in time of war for munition purposes. I see that is incorrect. We have only to pay to the General Chemical Co. when we manufacture for fertilizer purposes.
The CHAIRMAN. The General Chemical Co. had some patent, I suppose?
Major BURNS. Yes, sir; they had a patent on this Haber process, or a modification of the Haber process.
The CHAIRMAN. The Government undertook to put that in under their supervision, didn't they?
Major BURNS. Yes, sir.
The CHAIRMAN. And when they got it in it didn't work?
Major BURNS. Yes, sir; that is correct.
The CHAIRMAN. And the Government had agreed to pay, as you have read there, a royalty on everything it manufactured?
Major BURNS. Yes, sir; for fertilizer purposes.
The CHAIRMAN. Now, then has the question been raised as to whether or not this General Chemical Co., having offered to the Government its plan to manufacture fertilizer, and it having been ascertained that the Government, after spending about $13,000,000, discovered that it is a failure and a fake—has there been any claim made by the Government against the General Chemical Co. for damages?
Major BURNS. No, sir; but I think that——
The CHAIRMAN (interposing). Is there any such thing contemplated?
Major BURNS. No, sir. I would like to point this out, Senator; that this Haber process that was installed at nitrate plant No. 1 was really the pilot endeavor in America, and I think it would have been too much to expect the plant to work satisfactorily in the first effort. The General Chemical Co. has, in combination with the Semet-Solvay Co., at Syracuse, put in the process which they had patented, and it is now working satisfactorily.
The CHAIRMAN. Why didn't they put it in down there?
Major BURNS. I think they did the very best they could, Senator; but they didn't have enough knowledge at that time to make a satisfactory plant.
The CHAIRMAN. In other words, if they represented to the Government that they did have, and that that company would put it in, and having put it in, that it was going to work, why are they not liable to the Government for damages if it didn't work?
Major BURNS. I think the General Chemical Co.'s efforts in the construction of this plant were excellent. They had something which they thought would help the Government, and they offered it to the Government.
Senator MCKINLEY. Was it necessary for them to spend $13,000,000 to find out that it was a failure?
The CHAIRMAN. They were going to offer it to the Government, but they got paid for it?
Major BURNS. Of course, the $5 per ton of fixed nitrogen as royalty is only a nominal sum.
The CHAIRMAN. Is it small?

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Major BURNS. Yes, it is small. They asked nothing for the product when used for munitions purposes, and only $5 per ton of nitrogen for fertilizer, and even in that instance it is nominal. The General Chemical Co. was not responsible for the expenditure of $13,000,000 at the No. 1 plant. Approximately half of it went into their processes. The other half went into a plant for the conversion of the ammonia into other forms and finally into high explosives.

Senator MCKINLEY. Well, then, is that part still valuable?

Major BURNS. The part that converts the ammonia into nitric acid and ammonia nitrate is thoroughly satisfactory, but, of course, it is of no use as a fertilizer proposition. It is only good from a munitions standpoint.

Senator MCKINLEY. It is good for war?

Major BURNS. Yes, sir.

Senator MCKINLEY. Then, the Government ought not sell it, ought they?

Major BURNS. They ought not to sell it unless they can meet the demands for explosives in some other way. It is my judgment that they can meet their demands for explosives in some other way and it would therefore be an undue expenditure of Government money to keep that plant in stand-by condition for years. Of course, if the plant were going to be operated you would have a different problem to solve.

Senator MCKINLEY. As long as we have it, how much would you suggest that it would cost to keep it in stand-by, since we have $6,000,000 invested in it?

Major BURNS. It is costing us today, in round figures, about $40,000 a year to keep the No. 1 plant.

Senator MCKINLEY. But that is both parts of it?

Major BURNS. Yes, sir; all of the plant.

Senator MCKINLEY. How much would it cost to keep this $6,000,000 that is good for war purposes?

Major BURNS. I should say it would cost about half that.

Senator MCKINLEY. $20,000 a year?

Major BURNS. Yes, sir. With reference to the General Chemical Co., Senator, I believe that their attitude in this whole matter has been very fair. I think they honestly gave the Government everything they had to give and that they did not charge an undue price for their service.

Senator HEFLIN. But did they not tell the Government that this thing would be a success?

Major BURNS. No, sir. They made no guarantees to the Government. The Government needed help, and they went to the General Chemical Co., and the General Chemical Co., as I say, gave the Government all the help that it could. We were struggling to solve the problem. We had to get knowledge where we could get it, and they gave it to us as best they could.

The CHAIRMAN. Assuming all that to be true, if the Government needed help, as you say, and went to the General Chemical Co., and the General Chemical Co. said, "We have a process here now; you pay the expense of putting it in and then you pay us a royalty," and the Government did pay; they didn't pay anything. The General Chemical Co. did not put up a dollar. The Government did it all.

Major BURNS. That is correct.

The CHAIRMAN. And when they got through they expended all that money and found the thing was not any good; it would not work. There is a big difference between a company or a man saying to another man, "I will put in your machinery here; I have got a thing that will work, and I will put in this machinery, and you pay all the expense, and then you pay me a royalty"—there is a big difference between his doing that and doing the other thing, by saying, "You can have it; use it as you please, and I will help you all I can without pay." There is a consideration in one case and there is not in the other. There is liability for damages in the one case and there is not in the other. If they went into it to get money out of it and made representations, "Here, we have a thing that will produce so-and-so," and the Government spent its money on that kind of a promise to find out that it would not produce it——

Senator HEFLIN. In other words, the statement of the General Chemical Co. caused the Government to expend this money?

Senator MCKINLEY. $13,000,000.

The CHAIRMAN. If the General Chemical Co. was giving it to the Government, and was getting nothing out of it itself, that would be one thing; but if they were making that proposition with a view of getting a royalty for themselves, that is another thing. That is an entirely different legal proposition.

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Major BURNS. Yes; it would be, as I see it; but the General Chemical Co. never expected to get any appreciable amount of money out of the plant that they erected at Muscle Shoals.

The CHAIRMAN. That may be true, and I think probably this discussion is not material.

Senator MCKINLEY. Let me ask one question: Why didn't they use the Haber process?

Major BURNS. The first plant constructed was a modification of the Haber process.

Senator MCKINLEY. Why didn't they use it? They modified machine guns and artillery and airplanes and everything else.

Major BURNS. I think that is a very pertinent inquiry. I think it would have been much better if they had used the Haber process, but unfortunately they didn't know the Haber process. The best information was with reference to the General Chemical Co.'s process, which was a modification of the Haber process. So they really went as close to the Haber process as they could.

The CHAIRMAN. I saw a contract or a letter of some kind that the employees or chemists of the United States, when they were putting in this process, if any new discovery was made, even by the Government chemists, it would inure to the benefit of the General Chemical Co., and they would turn it over to them, and it would be patented for their benefit.

Major BURNS. Yes, sir. I think you are absolutely correct with reference to Nitrate Plant No. 1. When you asked that question before it was with reference to Nitrate Plant No. 2.

The CHAIRMAN. Is that in this contract?

Major BURNS. There was an agreement by which patents of the General Chemical Co. would be very completely protected.

The CHAIRMAN. Was there not an agreement that if they discovered an improvement, even though it was discovered by a Government chemist, it would inure to the benefit of the General Chemical Co. and be patented in their name?

Major BURNS. I think you are correct, Senator. I will read the clause in the agreement, though: "If this tender shall be accepted, the General Chemical Co. hereby undertakes forthwith to communicate with the designated experts for the Government all of its knowledge and discoveries pertaining to the said processes and apparatus, whether or not the same shall be the subject of patents, and from time to time thereafter, so long as the Government shall continue the use of said processes, to communicate all further improvements promptly as they shall come to the knowledge of the company and without further charge for the use thereof, within and subject to the limitations before expressed. And reciprocally, it is understood that all modifications and improvements in the processes or apparatus, which the Government shall discover or employ, shall be at the disposal of the General Chemical Co. and its licensees, if any, for use in its or their own works, and that all such modifications and improvements shall be freely exhibited upon request to the representatives of the General Chemical Co."

The CHAIRMAN. All right.

Senator HEFLIN. I understand from that contract, then, that the Government agreed there that if it should make any improvement, discovery, or a process that would be better than the one that they were then employing the Government could not profit by it, but should surrender its rights to the General Chemical Co.

Major BURNS. I don't think it said that, Senator.

Senator HEFLIN. That is the way I got the reading of it.

Major BURNS. If that is your judgment from the reading of it, of course that is the answer.

Senator HEFLIN. Read that line again there, where it said something about any discovery made by the Government.

Major BURNS (reading): "The General Chemical Co. hereby undertakes forthwith to communicate to the designated experts for the Government all of its knowledge and discoveries pertaining to the said processes and apparatus, whether or not the same shall be the subject of patents, and from time to time thereafter, so long as the Government shall continue the use of said processes, to communicate all further improvements promptly as they shall come to the knowledge of the company, and without further charge for the use thereof, within and subject to the limitations before expressed. And, reciprocally, it is understood that all modifications and improvements in the processes or apparatus which the Government shall discover or employ"——

Senator HEFLIN. There it is.

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Major BURNS (continuing reading): "Shall be at the disposal of the General Chemical Co. and its licensees, if any, for use in its or their own works, and that all such modifications and improvements shall be freely exhibited upon request to the representatives of the General Chemical Co."

In other words, they agreed to give us the benefit of all knowledge which they developed and we in turn agreed to give them the benefit of all knowledge which we developed.

Senator HEFLIN. Do you understand by that that we can make an improvement on their process and ask to have it patented, and we could get it and operate it independently of them?

Major BURNS. That is with reference to future action. The Judge Advocate General has held that this contract, in so far as it relates to new developments, is ended, and that if the Government at the present time develops any new thing in the matter of fixation of nitrogen it does not have to give it to the General Chemical Co., and, reciprocally, we are not entitled to anything developed by the General Chemical Co.

The CHAIRMAN. Do you know, Major, whether at this plant, while this partnership existed, any new discoveries were made with reference to anything connected with this business?

Major BURNS. I think, without doubt, there was a good deal of development as a result of this work.

The CHAIRMAN. Do you know whether they were patented?

Major BURNS. No, sir, I don't; but all sides naturally learned a lot from their attempted operation of this plant, and I think that this experience was of the greatest benefit to the General Chemical Co., because it has been able to apply the knowledge which it gained from construction and operation of this plant at Sheffield to the plant at Syracuse. I believe the Syracuse plant would not have been the success it has been without the experience at Sheffield.

The CHAIRMAN. Yes. That is very probable. In other words, if the General Chemical Co. had started out to build its plant at Syracuse without the experience it had down there it would have made a failure at Syracuse like it made for the Government?

Major BURNS. It would have had to go through its teething troubles, so to speak.

The CHAIRMAN. So at least they had the advantage of the Government paying for the development?

Major BURNS. In my judgment that was of very substantial assistance to them.

The CHAIRMAN. That would be of very substantial value to them?

Senator HEFLIN. If discovery had been made and patent had been asked and granted on a process that was an improvement on or addition to the process that we got from the General Chemical Co., what authority or ownership over that would the Chemical Co. have and exercise?

Major BURNS. As I read this agreement, the Government would have the right to patent the idea, but it would have to allow the General Chemical Co. or any of its licensees to use that patent free of charge.

The CHAIRMAN. Well, that would mean everybody, would it not? On the face of it, it would be very reasonable, it seems to me, to allow them that privilege. In other words, give them the same right that the Government secured from them from their partnership in this business: If the Government discovered anything new, let the Chemical Co. use it; but if we allow the Chemical Co. not only to use it but to give its licensees the right to use it, you give them the right to sell it to anybody on earth.

Major BURNS. Yes, sir.

Senator HEFLIN. And we are paying them for the use of their property?

Major BURNS. Yes.

The CHAIRMAN. Yes.

Major BURNS. But we are paying them only a nominal sum.

The CHAIRMAN. The Government does not get the right to assign anything to anybody else. It only works one way.

Major BURNS. That is my interpretation.

Senator HEFLIN. If a Government official should discover a process that was an improvement on this process, and we want to employ that to go ahead and turn out fertilizer, we have got to pay them a royalty still on that, although we are employing an improved process and one that was discovered and made by the Government?

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Major BURNS. As I said before, in accordance with the decision of the Judge Advocate General, this contract, as far as future development of ideas is concerned, is null and void. As to whether his opinion would be upheld by the court, I don't know. But, at any rate, he thinks that this contract has stopped to act in so far as it pertains to new patentable ideas or new developments or anything of the kind. He does not hold, however, that we would be relieved from paying royalty for use of the patented process of the General Chemical Co.

Senator HARRISON. You said that a royalty of $5 a ton is nominal. What is the capacity of the plant? What is it proposed to make, and about how much would it amount to per year?

Major BURNS. It would have fixed about 8,000 tons of nitrogen per year, and that in turn would, on the basis of $5 per ton, amount to $40,000 per year to the General Chemical Co.

Senator MCKINLEY. I wanted to ask a question, but I don't want to interfere with the continuity of your statement.

Major BURNS. I was going on to describe the situation at Gorgas.

Senator MCKINLEY. I wanted to just definitely get in something about this cost at plant No. 2.

Now, I suppose that the only way that the layman has to get an idea of cost is in comparison with Chilean nitrate?

Major BURNS. Yes, sir.

Senator MCKINLEY. Which I understand is about $60 per ton now?

Major BURNS. No, sir; it is lower than that now. It is somewhere between $45 and $50 per ton.

Senator MCKINLEY. Well, we will say $50 per ton. Now, in order to create a fertilizer which will act in the general way on soil the same as the Chilean nitrate, about what would you have to create by way of power—per horsepower—in order to compete at $50 a ton?

Major BURNS. In my judgment, the No. 2 nitrate plant can not be operated so that it can compete with Chilean nitrate sold at $50 a ton unless you get power at less than 1 mill per kilowatt hour, and even then the margin would be very slight.

Senator MCKINLEY. Well, now, Colonel Barden says that that plant, figuring 4 per cent interest, 5 per cent depreciation—I think he says so here in his testimony—5 per cent operation, depreciation, and so on, and 4 per cent interest, would make the power cost 3.08 mills per kilowatt hour. That would be 5 mills per kilowatt——

The CHAIRMAN (interposing). Per horsepower?

Senator MCKINLEY. No; it is the other way. It would be 3 mills per horsepower.

Major BURNS. A little less than the price per kilowatt; yes, sir.

Senator MCKINLEY. That would be 3 mills. Now, if you have to have it at three-quarters of a mill——

The CHAIRMAN (interposing). He says a mill.

Major BURNS. Less than a mill.

The CHAIRMAN. Less than a mill; yes.

Senator MCKINLEY. Yes, or even a mill. If you have to have it as low as a mill, then this costs three times as much for power as you would have to compete at all with the Chilean nitrate?

Major BURNS. Yes, sir. In my judgment the cyanamid plant at Muscle Shoals, unless some new development comes along that we can not at present foresee, can not enter the commercial market with power in excess of one mill.

Senator MCKINLEY. But the figures are in excess of three mills.

Major BURNS. At 3 mills I do not think it could compete in the commercial market at all.

The CHAIRMAN. That is the cyanamid process?

Major BURNS. Yes, sir.

The CHAIRMAN. What about the Haber process?

Major BURNS. As I stated yesterday, the consumption of power in the Haber process, provided you get your gas from coke, is so relatively small, that the cost of power does not have any appreciable effect upon the cost of the product.

The CHAIRMAN. Let us take into consideration, now, everything that you have down there. Assuming that the process down there, by the expenditure of $5,000,000 more money, can be made to work successfully, can that plant be operated so as to compete with Chilean nitrates at $50 a ton?

Major BURNS. In my judgment, it can; yes, sir.

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The CHAIRMAN. The Haber process?

Major BURNS. Yes, sir; I think the Haber process has sufficient possibilities to do that.

Senator MCKINLEY. But the power has nothing to do with it?

Major BURNS. No, sir; it is not the determining factor.

Senator MCKINLEY. That is, you could go any place where you have coal?

Senator NORBECK. That plant can not be operated successfully that far from the source of the fuel supply where it is now operated?

Major BURNS. I believe that plant could be operated successfully at Sheffield.

Senator HARRISON. What has been the average price of Chilean nitrate. Have you got it there?

Major BURNS. Yes, sir.

Senator HARRISON. What was the peak during the war?

Major BURNS. The peak during the war was about $100 per ton.

Senator HARRISON. What is the cheapest it has been during the last five years?

Major BURNS. I think it has been down to a little below $40.

Senator HARRISON. You think that the present price of $50 per ton is about the average price?

Major BURNS. My judgment would be that the price of nitrate of soda will probably fluctuate between $40 and $60, unless some emergency comes along when the price would be much higher. On the other hand if it should happen that farmers would not be able to buy fertilizer the prices would likely go lower. I have a chart here showing the average costs of Chilean nitrate over a period of years.

Price per short ton of nitrate of soda.

Year.	High.	Low.	Average.	Year.	High.	Low.	Average.
1907	$51.00	$47.00	$49.00	1915	$58.00	$38.00	$48.00
1908	48.00	43.00	45.00	1916	71.00	58.00	64.00
1909	44.00	42.00	43.00	1917	94.00	63.00	80.00
1910	43.00	42.00	42.50	1918	103.00	86.00	95.00
1911	45.00	42.00	43.00	1919	88.00	58.00	73.00
1912	52.00	44.00	48.00	1920	78.00	56.00	72.00
1913	53.00	44.00	50.00	1921	58.00	40.00	50.00
1914	45.00	38.00	42.00				

Senator NORBECK. I am not sure, Major, that I understood you. I would like to ask one more question. I think you said that if certain materials were available the Haber process could enter into competition, because the amount expended for power was low. What are the other requirements, the more expensive requirements for that process, outside of power?

Major BURNS. Coke is the principal material, and some special chemicals in small tonnage quantities are also required.

Senator NORBECK. Would the location be favorable from the standpoint of coke?

Major BURNS. Reasonably so; yes, sir. You can get coke quite easily from Birmingham.

Senator NORBECK. Would the location at Birmingham be very much more favorable for that process?

Major BURNS. I think the location at Birmingham would be slightly more favorable than Sheffield; yes, sir. It should be remembered, however, that while power does not play any great part in the Haber process, cheaper power will certainly help the Haber process.

Senator NORBECK. I was wondering to what extent the shipment of coke would enter into the cost of it; whether that was a large factor or a smaller one.

Major BURNS. I don't think it would be very large.

The CHAIRMAN. The power at Sheffield would be a little less expensive than it would at Birmingham, wouldn't it?

Major BURNS. Yes, sir; it might be.

The CHAIRMAN. Where it is now located?

Major BURNS. In other words, I don't want to say that you ought not to use the very cheapest power you possibly can, because of course the cheaper you can get any of your materials the cheaper the final product is going to be.

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The CHAIRMAN. Certainly. Now, coke seems to be one of the important items of expense.

Major BURNS. Yes, sir.

The CHAIRMAN. If you got your coke from Birmingham, it would be shipped over the railroad to Sheffield?

Major BURNS. Yes, sir.

The CHAIRMAN. When these dams are completed would the navigation on the Tennessee River help out any on the supply of coke that is shipped in? Is there any place along the Tennessee River where coke would be made and shipped by water to Sheffield?

Major BURNS. I know of none, sir.

Colonel BARDEN. There are large coal fields in the upper Tennessee Valley; coal mines right on the river below Chattanooga. I don't know of any coke ovens, but there is coal there.

The CHAIRMAN. Do you know whether it is coking coal?

Colonel BARDEN. No; I do not; but there is a large quantity of coal.

Senator MCKINLEY. Major, it would be perfectly feasible to build the Haber plant, if you have got to build a new one, at Birmingham, and take that power over by wire from Muscle Shoals, wouldn't it?

Major BURNS. Yes, sir.

The CHAIRMAN. Suppose instead of building it at Birmingham you built it at Gorgas and used the transmission line that we already have, that we now own, from Gorgas over to Muscle Shoals. That would be cheaper still, would it not, than to go to Birmingham? You get coke from Gorgas?

Major BURNS. Well, you could by putting in a coke oven. Of course, they have lots of coal there.

The CHAIRMAN. Yes. There is nothing but coal around Gorgas.

Major BURNS. Yes, sir. You could put in coke ovens, of course.

Senator MCKINLEY. I suppose the coke ovens are already at Birmingham, are they?

Major BURNS. Yes, sir. They make a great deal of coke at Birmingham.

The CHAIRMAN. You could put in your coke oven and get your coal and coke there cheaper than you could at Birmingham, and build your plant over there, if you wanted to use water power, use the transmission that you now have, instead of taking it from Gorgas over to Birmingham. I think your power there at Gorgas would be the cheapest that could be obtained, from coal right at the mouth of the coal mine.

Major BURNS. Yes, sir. It is pretty hard to beat the Gorgas steam power plant from a coal-supply point of view.

The CHAIRMAN. Taking it all in all, would it not pay the Government, if it were going to put in the Haber process, to go to Gorgas and build it there, where you would have cheap coal and cheap coke, so you would have cheap power and coke both?

Major BURNS. There are so many factors that enter into the situation that it would be very hard to answer. You have got to look at the labor market, as well as the other items. There is no doubt but that the labor market is more limited at Gorgas than at Birmingham.

The CHAIRMAN. The labor item is not of very much importance in the Haber process, is it?

Major BURNS. No, sir; the labor in the Haber process is not great in amount, but it has got to be quite skilled, because it is a complicated chemical process, and you need good mechanics.

The CHAIRMAN. You would not need so very many men, though?

Major BURNS. It would all depend on the size of the plant you are going to install.

The CHAIRMAN. Of course, if we knew it was going to be a success we would build a larger plant than you built there at Sheffield. That was, to some extent, an experimental plant?

Major BURNS. Yes, sir; that is not a real large producer.

Senator MCKINLEY. What is the percentage of production of fertilizer at that plant as compared with the cyanamid plant?

Major BURNS. That is one-fifth as large as the cyanamid plant. The No. 2 plant is able to fix about 40,000 tons of nitrogen a year. The by-product coke ovens are producing to-day about 100,000 tons of inorganic nitrogen per year, and we are importing, in round figures, from Chile 100,000 tons of nitrogen per year. So the No. 2 plant represents about 20 per cent of all the inorganic nitro-

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gen that is being used in the United States to-day. Now, the No. 1 plant would similarly be one-fifth of 20 per cent, or about 4 per cent of the consumption of inorganic nitrogen in the United States at the present time.

The CHAIRMAN. I get those plants somewhat mixed. No. 1 plant is the Haber process?

Major BURNS. Yes, sir.

The CHAIRMAN. Now, let us get that again. It seems to me that is quite important. Compare the output of those two plants with the amount of the product used in the United States.

Major BURNS. Yes, sir; at the present time the by-product ovens are producing about 100,000 tons of inorganic nitrogen per year. We are importing from Chile about 100,000 tons of inorganic nitrogen per year. In other words, the consumption of inorganic nitrogen in the United States at the present time is approximately 200,000 tons per year.

The cyanamid plant at Muscle Shoals, or nitrate plant No. 2, is capable of producing approximately 40,000 tons of nitrogen per year, or it represents about 20 per cent of the entire consumption of inorganic nitrogen in the United States. Similarly the United States nitrate plant No. 1, the Haber plant, located at Sheffield, could produce about 8,000 tons of inorganic nitrogen per year, or it is equal to about 4 per cent of the total inorganic nitrogen consumed in the United States.

Senator HEFLIN. All that could be used for manufacturing purposes?

Major BURNS. Yes, sir.

Senator HEFLIN. About how many tons of fertilizer would that make? Can you tell us?

Major BURNS. Yes, sir. The ordinary fertilizer contains approximately 2 per cent of nitrogen. So that if you multiply those figures by 50 you will get the tonnage of fertilizer that could be supplied with nitrogen. The No. 2 plant, therefore, would have a total fertilizer equivalent of 50 times 40,000, or 2,000,000 tons of fertilizer. Similarly, the No. 1 plant would have an equivalent of 50 times 8,000, or 400,000 tons of fertilizer.

Senator MCKINNEY. How many tons do you put on an acre to fertilize?

Major BURNS. I don't know, sir; but there are being used in the United States to-day approximately 7,000,000 tons of fertilizer per year.

The CHAIRMAN. The amount they put on the acre depends, I suppose, on the nature of the soil and the crop that is to be produced.

Senator MCKINLEY. There is a law of averages in almost everything.

Senator HEFLIN. Sometimes they put a quarter of a ton, sometimes half a ton, and in very few instances I think they put as much as a ton.

Senator MCKINLEY. According to that, then, if we can produce 800—how many tons did you say?

Major BURNS. About 7,000,000 tons.

Senator MCKINLEY. No; I mean at this plant.

Major BURNS. Two million tons.

The CHAIRMAN. Two million tons at one plant and four hundred thousand tons at the other plant.

Major BURNS. It only produces the nitrogen for that amount of fertilizer.

The CHAIRMAN. I understand that; yes. There is that quantity when it becomes completed fertilizer?

Major BURNS. Yes, sir.

The CHAIRMAN. Only 2 per cent of that is nitrogen?

Major BURNS. That is correct, sir.

Senator MCKINLEY. Then, on the basis of 2,000,000 tons, if we use one-half ton to the acre, that would be 4,000,000 acres?

Major BURNS. Yes, sir.

The next point that I was going to take up was the Gorgas Steam Plant, located on the Warrior River.

When the Government decided to build the cyanamid plant at Muscle Shoals its greates worry was power. It had to have power quickly and in very large quantity. So after a good deal of study and discussion a contract was entered into with the Alabama Power Co. by which that company was to increase the plant which it had already installed at Gorgas from a 20,000-kilowatt plant to a 50,000-kilowatt plant. The plant was built at the expense of the United States by the Alabama Power Co., which company placed at the disposal of the Government its engineering and construction forces.

The No. 2 plant was started, I think, in February, 1918, and as the result of this contract with the Alabama Power Co. it had power by the 1st of June,

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1918, which was of great benefit for construction purposes, as well as for starting operations.

There is a proviso in the contract with the Alabama Power Co. by which the Government is required to sell to the Alabama Power Co. this plant at a price to be fixed by a board of arbitrators, the board of arbitrators to be made up from a representative from the Government, a repesentative from the Alabama Power Co., and a third to be selected by the two. This Gorgas plant has been under a good deal of discussion, because it is included in the offer of Mr. Ford, and the Ordnance Department has felt constantly that it is practically impossible to live up to the Ford offer in that respect.

Senator HARRISON. What was the cost of that plant there?

Major BURNS. The power plant, with its substations, cost, in round figures, $4,000,000.

Senator HARRISON. And what was the cost of the improvement that the Alabama Power Co. put in at the instance of the Government?

Major BURNS. That is the figure that I am giving you now. As to what their own plant cost, I don't know.

When the war started the Alabama Power Co. had installed at Gorgas the portion as shown on this map that is colored in yellow.

The CHAIRMAN. And that is true of the entire map, is it not, Major?

Major BURNS. Yes, sir.

The CHAIRMAN. Everything that is on there in red was put on after the war?

Major BURNS. Yes, sir.

The CHAIRMAN. And under this contract with the Alabama Power Co.?

Major BURNS. At the expense of the Government; yes, sir.

The CHAIRMAN. At the expense of the Government. All right. Now, go ahead.

Major BURNS. All of the land belongs to the Alabama Power Co. The Government-built improvements were all put upon the Alabama Power Co.'s property. Of course, the idea constantly was that the whole thing would be sold to the Alabama Power Co. after the needs of the Government had been met.

The power plant proper consists of boiler plant and turbines, and these are under the same roof as those owned by the Alabama Power Co. Both Government and Alabama Power Co. plants are fed by water that comes through the same water intake. The coal comes up over railroads that are jointly owned, and power goes out through a substation that is jointly owned. The housing facilities are half the Alabama Power Co.'s and half the Government's. The Alabama Power Co. has a large coal mine in this vicinity, and they have various openings in the adjacent hills through which they extract coal for use in this plant. The Alabama Power Co. put its plant here because of this excellent location in the matter of coal supply.

Senator HEFLIN. Power is furnished to nearly all of these coal mines around there from this plant?

Major BURNS. I think so; yes, sir.

In order to get power up to Muscle Shoals there was constructed what is known as the Warrior-Sheffield transmission line, 90 miles long, which carries or could carry about 30,000 kilowatts of energy.

This was also constructed by the Alabama Power Co. at a cost of approximately a million dollars.

The CHAIRMAN. That is, the transmission line?

Major BURNS. Yes, sir.

The CHAIRMAN. I was under the impression the Government constructed that.

Major BURNS. It was constructed by the Alabama Power Co. at Government expense.

The CHAIRMAN. The Government put up the money?

Major BURNS. Yes, sir. The land on which the transmission line was built is either owned or controlled by the Alabama Power Co.

The CHAIRMAN. I supposed it ran along public highways.

Major BURNS. No, sir. There is a right of way 90 miles in length over the mountains. I think it is 100 feet wide.

The CHAIRMAN. Owned by the Alabama Power Co.?

Major BURNS. Either owned or controlled by it. And we have an agreement with the Alabama Power Co. by which that transmission line will also be sold to the Alabama Power Co. in the same way, or practically the same way, as the Gorgas power plant is to be sold.

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The CHAIRMAN. This right of way was not owned, at the time this contract was made, by the Alabama Power Co., was it?

Major BURNS. No, sir; but the Alabama Power Co. acquired the right of way. I think the reason why they acquired it at that time was that the Government officials did not feel that they had authority to get the land in the name of the United States. They felt that there was a restriction of law prohibiting them from either purchasing the land or getting rights of way over the land.

Senator MCKINLEY. Someone down there told us that the Alabama Power Co. did own, at the time the war started, 30 miles of that right of way.

Major BURNS. I have no doubt but what that is correct.

I should add, in order to more fully cover the matter, that the question as to whether the option of the Alabama Power Co. to purchase the Gorgas plant was legal was submitted to the Judge Advocate General, and he held that it is null and void; but the Ordnance Department feels very strongly that the Government ought to live up to the contract, and dispose of the property, in accordance with the contract, to the Alabama Power Co. It was made in good faith, and we feel that the Alabama Power Co. has played the game fairly with the Government, and is entitled to a fair solution to the problem.

The CHAIRMAN. The Gorgas plant and the transmission line are something entirely independent of the Muscle Shoals improvement or any of the governmental activities there, as I understand it. It could be separated without injuring anything else?

Major BURNS. It is a matter of judgment. In my judgment it absolutely can be. I can see practically no tie-up between Gorgas and Muscle Shoals. However, there are other people that do not feel that way about it.

The CHAIRMAN. I can see how they could use them together, but without any injury they could be used separately, it seems to me.

Major BURNS. That is my judgment.

The CHAIRMAN. Of course, they could both be used by the same people in the same business. That is perfectly clear.

Major BURNS. Yes, sir.

The CHAIRMAN. But it would be a difficult thing to divide this scrambled egg over Gorgas between the Government and the Alabama Power Co., it seems to me, no matter how anxious you might be to do it.

Major BURNS. Yes, sir.

Senator NORBECK. I want to get back to that Haber plant. They got their power from the Warrior plant for the purposes of construction work?

Major BURNS. They have been getting all of their power at the Wilson Dam from the Alabama Power Co., carried up over this 90-mile transmission line through the nitrate plant to Wilson Dam, which is connected with nitrate plant No. 2 by transmission line.

Senator NORBECK. They are getting it from the Alabama Power Co.

Major BURNS. Yes, sir.

Senator NORBECK. Not from the Government plant at Gorgas?

Major BURNS. Well, the Government plant at Gorgas is being operated by the Alabama Power Co. under contract. They have to pay us so much per kilowatt-hour for every unit of energy generated in that plant.

Senator HEFLIN. Suppose Mr. Ford should get Muscle Shoals and go on with the construction of the dam there; where would he get his power?

Major BURNS. He could get it from the steam plant at No. 2. He could put that in operation, or he could put the steam plant at nitrate plant No. 1 into operation, or if he didn't want to do either he could purchase power from anybody that would sell it to him.

Senator HEFLIN. Could he get all the power he needed at plant No. 2?

Major BURNS. Oh, yes. He could get 60,000 kilowatts. He would use 2,000 kilowatts, at the most, in construction.

The CHAIRMAN. The Government, if they were going to complete it, would utilize or at least it has two steam plants that could be utilized?

Major BURNS. Yes, sir.

The CHAIRMAN. One at nitrate plant No. 1 and one at nitrate plant No. 2.

Major BURNS. Yes, sir.

The CHAIRMAN. With a combined horsepower of what?

Major BURNS. Sixty-five thousand kilowatts.

Senator MCKINLEY. One hundred and thirty thousand horsepower.

Senator HEFLIN. But plant No. 2 can not be used, then——

The CHAIRMAN. Let us get this definitely on the record before we leave it.

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Is that kilowatts or horsepower?

Major BURNS. It would be 65,000 kilowatts, or nearly 90,000 horsepower.

The CHAIRMAN. Plant No. 2 has 90,000 horsepower capacity, has it not?

Major BURNS. It has 60,000 kilowatts, and that would be——

Senator MCKINLEY. What about these two 2,500 kilowatts in there?

The CHAIRMAN. Let him answer that question first, if you please. I want to get that definitely.

Major BURNS. No. 2 plant has installed generating capacity to the extent of 60,000 kilowatts.

The CHAIRMAN. Yes; but that is not its full capacity.

Major BURNS. Yes; that is its full generating capacity.

The CHAIRMAN. Is it?

Major BURNS. Yes, sir. It has, however, boiler capacity installed which would allow you to generate 90,000 kilowatts.

The CHAIRMAN. That is what I was thinking about.

Major BURNS. But the generating equipment has not been installed, although the place is there for its installation.

The CHAIRMAN. I understand. Then the power capacity of that steam plant No. 2 is how much?

Major BURNS. At present the generating capacity——

The CHAIRMAN. Not the generating capacity. What is the total power capacity? If you haven't got the machinery there, put in enough.

Senator MCKINLEY. He means the steam boilers.

Major BURNS. There is steam capacity there for 90,000 kilowatts.

The CHAIRMAN. That would be how many horsepower?

Senator MCKINLEY. About 120,000?

Major BURNS. About 120,000 horsepower.

The CHAIRMAN. Well, that is more power than anybody would use to build Dam No. 1 and Dam No. 2, even if they built them both at once, is it not?

Major BURNS. Oh, yes. The power requirements for the construction of dams is relatively small.

The CHAIRMAN. As far as using power for the construction of either one or both of these dams is concerned, it is not at all necessary to have the Gorgas plant?

Major BURNS. No, sir.

Senator MCKINLEY. They could buy the power from the Alabama Power Co. for the small amount of power required cheaper than they could keep up the fires in those steam plants?

Major BURNS. Yes, sir; and that is what the Government has been doing for two years.

Senator HEFLIN. And it came from the Gorgas plant?

Major BURNS. It came from the system of the Alabama Power Co. It might have come from Gorgas or from the Coosa River hydroelectric plant.

Senator MCKINLEY. Is it not a fact that they only run the Gorgas plant two or three months in the summer?

Major BURNS. They run it more than that. They run it, I should say, three-fourths of the time.

Senator MCKINLEY. I should think they would use water power.

Major BURNS. As I understand it, their load is so heavy that they have to back it up almost constantly with the Gorgas steam plant.

The CHAIRMAN. The steam plant at Government nitrate plant No. 2 indicates that even with Gorgas they are not sure of having power all the time?

Major BURNS. Yes, sir; that is correct.

The CHAIRMAN. They are paying us $40,000 a year, are they not, for steam plant No. 2?

Major BURNS. They are paying us $10,000 a month and 2 mills for each kilowatt hour that they generate.

The CHAIRMAN. In addition?

Major BURNS. In addition; yes sir. And they are also required to maintain the plant and turn it back to the Government in as good condition as when it was received by them.

Senator HEFLIN. Major, I understand you to say that plant No. 1 can be used now for power purposes?

Major BURNS. Yes, sir; it could be. Of course, it would be very expensive power, because that is a small power plant.

Senator MCKINLEY. It could make 5,000 kilowatts there for all the dam construction?

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Major BURNS. Yes, sir.

The CHAIRMAN. That would not be expensive power, would it, Major? Why is it expensive?

Major BURNS. Any small power plant is expensive.

The CHAIRMAN. Yes; but if you are using it to its capacity. You shut down your big plant because you did not need so much power, you say. Can't you operate the little plant at nitrate plant No. 1?

Major BURNS. We studied that, and we found we could buy power from the Alabama Power Co. much cheaper than we could operate that plant.

Senator MCKINLEY. It would probably cost you 15 mills to operate that plant and you could probably buy it for about 9 mills?

Major BURNS. About that. I think it would cost us in excess of 2 cents, or 20 mills, to make power at that plant.

The CHAIRMAN. How far, Major, without material loss, can this energy be carried?

Major BURNS. Well, I think that they figure that you can carry power about 150 miles, though I saw a piece in the paper a few weeks ago which showed that out in California they were getting ready to carry power 300 miles.

Senator MCKINLEY. Is it not a fact, Major, that San Francisco is supplied with power from 200 miles away? In fact, it is supplied from plants in two directions 200 miles, where the plants are 400 miles apart?

Major BURNS. It is essentially a question of the voltage that is used. The ordinary voltage to-day is about 110,000 volts, and they are constantly endeavoring to raise that. Out in California they are hoping to send power at 220,000 volts. The more pressure you get behind power the less your line loss is. I don't think there is any doubt but what in a few years they are going to extend the zone over which power can be sent economically very materially.

The CHAIRMAN. If that occurs, as it is likely that it will, laying aside all the other questions that we have been discussing, if that improvement occurs, then that of itself would add very materially to the value of a power development like Dam No. 2?

Major BURNS. Oh, yes, sir; very materially. A few years ago that power could have been used only in a very small radius around Muscle Shoals. Now it can unquestionably be used economically 150 miles, and, as I said before, I don't think there is any doubt but what in a few years that radius will have been increased to probably 300 miles or more.

Senator HEFLIN. Don't they claim now that you can transmit between 350 and 400 miles?

Major BURNS. There is no doubt but that you can transmit that distance, Senator. It is a question of how economically you can do it, because your losses and transportation charges mount up quite rapidly as the distance increases.

The CHAIRMAN. Now, as I understand it, the value of this development down there, or the possibility of utilizing it for fertilizer purposes, depends to some extent upon several things. One is the development of improvements in the machinery for extraction of nitrates from the air. That looks favorable. Another one is whether or not at reasonable cost reservoirs can be built in the upper Tennessee or its tributaries that would increase the amount of primary power.

Major BURNS. Yes, sir.

The CHAIRMAN. Are there any other possibilities that might improve the situation, outside of those two I have mentioned?

Major BURNS. I think the principal ones are the cheapness of power and further developments in the chemical processes.

The CHAIRMAN. Unless we can cheapen the power or cheapen the process, we can not hope to manufacture fertilizer from plant No. 2 cheap enough to compete with the markets of Chile. Is that your idea?

Major BURNS. You can not lower the price of Chilean nitrate by the operation of plant No. 2, as I see it to-day. I have always felt, however, if that plant were operating, that it would have a stabilizing effect upon nitrogen fertilizer materials, because it would eliminate some of the hills, so to speak, of the prices in materials. But the No. 2 plant, as things stand to-day, can not be relied upon to have any appreciable effect in reducing the present-day prices of nitrogenous fertilizers.

Senator MCKINLEY. Major, let me ask you this: This is something I don't know about, along with a good many other things. These by-product coke ovens. Tell us about that. Is that from all coke ovens?

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Major BURNS. No, sir. It only comes from the by-product ovens. As you know, there are two methods of making coke. One is by the beehive oven, and the other is the by-product oven.

Senator MCKINLEY. The beehive is the one you see along the railroads?

Major BURNS. Yes, sir. In the beehive ovens, you put a lot of coal in the oven and burn all the gas as it comes from the coal, and that gives you enough heat so that the volatiles of the coal are driven out. The volatiles amount, roughly, to 30 per cent of the weight of the coal. After that process is complete you have nothing left but some coke and ash, as all of the gases have been burned.

In the by-product system the coke is put in an oven and it is heated through the brick on the side, and all the gases are driven off but are all collected and used for one purpose or another. In other words, 30 per cent of the weight of the coal is saved in the form of by-products. One ton of coal in a by-product oven will produce about 11,000 cubic feet of gas. It will produce about 10 gallons of coal tar; it will produce about 5 pounds of ammonia; it will produce about 3 gallons of light oils, or motor spirits.

The CHAIRMAN. And after you have gotten these by-products you still have the coke left?

Major BURNS. Yes, sir.

The CHAIRMAN. How much coke now?

Major BURNS. In a beehive oven you would get about 0.65 ton of coke from a ton of coal, and in the by-product oven you get about 0.70 to 0.73 of a ton of coke per ton of coal. In other words, you get about 10 per cent more in the by-product oven.

The CHAIRMAN. Of coke?

Senator MCKINLEY. About three-quarters of the weight in coal you get in coke?

Major BURNS. Yes, sir. It all depends, however, upon how much volatiles there happen to be in the coal. Coals vary. Everything that you get from a ton of coal in a by-product oven is worth about 50 per cent more than what you get out of a beehive oven.

Senator MCKINLEY. Where do you get your ammonia?

Major BURNS. That is included as one of the gases driven off in the production of the coke and can be separated from the other materials. As I said before, you get about 5 pounds of ammonia per ton of coal. They are coking sufficient coal in these ovens now so that, all told, there are some 100,000 tons of nitrogen recovered in the form of ammonia each year.

Senator MCKINLEY. That comes out of that ammonia?

Major BURNS. Yes, sir.

The CHAIRMAN. Now, Major, if all the coke was made in by-product ovens how much would that increase the nitrate?

Major BURNS. It would nearly double it, sir. At the present time we are coking in by-product coke ovens over 60 per cent of all coal coked.

Senator MCKINLEY. Tell us why it is that anybody can afford to use these beehive ovens when by that means they lose not only a portion of the coke but all these other by-products that are more valuable than the coke itself?

Major BURNS. There are certain economic reasons for it. In the first place, there is no market for the gas in some sections of the country.

Senator MCKINLEY. No; that is true.

Major BURNS. And it is the same with some of the other by-products, and freight is often the deciding factor.

The CHAIRMAN. Your nitrates are valuable, are they not?

Major BURNS. They are adways valuable; yes, sir; but the by-product coke oven costs a lot more than a beehive oven, and therefore requires satisfactory markets for its by-products to justify the increased costs. Furthermore, you can not shut down a by-product coke oven the way you do a beehive oven, because every time you shut it down contraction sets in and the brick walls are injured. So that the beehive oven will exist and be necessary as a minimum to take care of the varying load. As you know, the steel industry has just gone through a very marked period of depression. During that depression they did not use nearly as much coke as ordinarily.

The CHAIRMAN. They have to have coke?

Major BURNS. Yes, sir.

The CHAIRMAN. They can not use coal at all?

Major BURNS. No, sir. They are the big consumers of coke. However, some anthracite coal is used.

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When they had to shut down their ovens because they did not have the demand for coke the first ovens shut down were the beehive ovens, and the by-product ovens were kept in operation. In the steel business there is a fluctuation of some 25 to 30 per cent of the average production. It is our judgment that you can look forward to further extension of the by-product coke oven business, but I do not believe you will ever be able to coke 100 per cent of all coal in by-product ovens. We think if you get up to 70 or 75 per cent you will be doing extremely well. Now we have reached a percentage of over 70. In other words, we have gone over half the way.

The CHAIRMAN. In how long a time? These by-product ovens are comparatively modern, are they not?

Major BURNS. Yes, sir. I can give you that quite accurately.

The CHAIRMAN. I think that would be very well to have that in the record. I think it would be a very important thing for anybody who studies the record to be able to find that.

Major BURNS. I have a short paragraph here, taken from an ordnance paper, in reference to this subject:

"By-product coke ovens were developed by the Germans and first introduced into America about 1893. From this time until 1914, when the World War started, development was such that only 25 per cent of the coke used in the United States was coked therein. Since 1914 the increase has been quite rapid. The growth was developed during 1915 and 1916 by the purchase by the Allies of by-products at high prices. In 1917 and 1918 the Ordnance Department, in order to obtain increased supplies of ammonia and toluol, further speeded up construction. As a result of all these efforts the country is at the present time coking in by-product coke ovens 60 per cent of all its coke."

The CHAIRMAN. I guess it is about time to adjourn.

Senator HEFLIN. Mr. Chairman, there is one thing I want to ask the major before we leave this point.

The CHAIRMAN. All right.

Senator HEFLIN. You expressed doubt as to whether fertilizer could be produced at Muscle Shoals in competition with commercial fertilizer. Henry Ford claims that he can and will produce fertilizer there, and that he can do it cheaper than it is now being produced. The fact that the fertilizer trust in the United States is fighting the Ford bid would indicate that they fear that he can do it.

Major BURNS. The fact that they are fighting it indicates that they fear him as a competitor all right. There is no doubt about that.

Senator HEFLIN. Yes; which would indicate that the producer was going to be able, if Ford got it, to get his fertilizer at less than he now gets it.

Major BURNS. It seems to me you could interpret it that way.

Senator MCKINLEY. If it is agreeable to the chairman, Major, I wish you would put into the record at the proper place what, in your judgment, nitrate, as we consider—that means like the Chilean nitrate—what, in your judgment, it would cost down there on the basis of 3 mills per horse-power; about what it would cost per ton; that is, we figure at three-quarters to 1 mill, it would cost $50.

The CHAIRMAN. Yes. I think you see the point there.

Major BURNS. Yes, sir.

The CHAIRMAN. That would help us a good deal, Major, if you would do that.

Major BURNS. All right, sir.

(This information is inserted at a later point.)

(Whereupon, at 12 o'clock, noon, the hearing was adjourned to 10.30 o'clock a. m., Friday, April 14, 1922.)

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MUSCLE SHOALS

HEARINGS

BEFORE THE

COMMITTEE ON AGRICULTURE AND FORESTRY UNITED STATES SENATE

SIXTY-SEVENTH CONGRESS

SECOND SESSION

ON

S. 3420

TO PROVIDE FOR THE MANUFACTURE OF EXPLOSIVES FOR THE USE OF THE ARMY AND NAVY, TO PROVIDE FOR THE MANUFACTURE OF FERTILIZER FOR AGRICULTURAL PURPOSES, TO INCORPORATE THE FEDERAL CHEMICAL CORPORATION, AND FOR OTHER PURPOSES; AND

ON

THE HENRY FORD MUSCLE SHOALS OFFER; OFFER MADE BY THE ALABAMA POWER CO., PROPOSING TO COMPLETE WILSON DAM; OFFER OF FREDERICK E. ENGSTRUM FOR MUSCLE SHOALS, AND OFFER OF CHARLES L. PARSONS FOR PROPERTIES AT MUSCLE SHOALS, ALA.

APRIL 14 TO MAY 3, 1922

PART 2

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MUSCLE SHOALS.

FRIDAY, APRIL 14, 1922.

UNITED STATES SENATE,
COMMITTEE ON AGRICULTURE AND FORESTRY,
Washington, D. C.

The committee met, pursuant to adjournment, at 10.30 o'clock a. m., in room 224, Senate Office Building, Senator George W. Norris presiding.

Present: Senators Norris (chairman), McKinley, McNary, Capper, Norbeck, Kendrick, Harrison, and Heflin.

The CHAIRMAN. The committee will come to order. You may proceed, Major Burns.

STATEMENT OF J. H. BURNS, MAJOR, UNITED STATES ARMY—Resumed.

Major BURNS. I have very little more to say, Senator. I would like to show the relationship between nitrate plant No. 2 and nitrogen preparedness from a military standpoint. That, of course, has always been one of the prime objects of nitrogen fixation.

I have drawn two charts, one to show the general principle that you have to apply to munitions preparedness if you are going to be prepared for some future war, and the other is the application of the general principle to nitrogen.

The principle the Ordnance Department is striving to get established is that we must have on hand at all times sufficient stocks of munitions to tide us over until new production is adequate to meet the demands of the war plans, whatever they may be.

I have drawn here a theoretical curve of requirements to indicate the needs of the Army for munitions delivered at the fighting front.

Then I have drawn also a curve of production to indicate the production in any particular kind of munitions that America is able to achieve. Sooner or later munitions production can be made equal to, if not greater than, consumption; but during the early days of the war production can not equal consumption, because in the ordinary instance it takes at least 12 months longer to manufacture munitions and deliver them to the fighting front than it does to create new man power and place it upon the battle front.

The CHAIRMAN. You mean it would take longer to get munitions than it would to get the men?

Major BURNS. Yes, sir. On the average it takes at least 12 months longer to get munitions than men. That is very clearly proven by the experience of the World War, because, as you undoubtedly appreciate, while America did its best to get munitions, it was able to get practically no munitions of major size to the front lines, even though the war had continued for nearly 18 months.

Senator HARRISON. Of course that did not apply to Germany?

Major BURNS. No, sir; but the Germans met their problem by having quite large stocks of munitions on hand in order to tide over the production development period, while we had practically none.

Senator HARRISON. That statement just applies to the United States?

Major BURNS. Of course, that principle applies to any nation. They must have on hand stocks of munitions to tide over until production is adequate. To repeat, in the World War I do not believe we fired more than a few shots of large caliber munitions. Practically every large gun and every round of muni-

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tion, therefore, was obtained from the Allies, and the reason for it was that we had no stocks on hand. As I said before, there will come a time when production will equal consumption. Therefore, if you want to be adequately prepared for any war plan you must have reserve stocks on hand as a minimum equal to the difference between the production curve and the consumption curve at the time the rate of production equals the rate of consumption. That is represented by this line here [indicating]. That is the general principle of munition preparedness.

Now, I have applied the general principle to nitrogen on the assumption that we would raise an army in a future war at about the same rate at which we raised it in the World War. It is assumed also that it would be placed in battle at an earlier date than our World War Army. These assumptions give us a definite statement of requirements.

This curve indicates the requirements of nitrogen under such an assumption, and shows that about 22½ months after the war we would have required a total of about 110,000 tons of nitrogen, all delivered at the fighting front.

This [indicating] is the curve of production that we think we could get from America. In order to develop the curve of production we have to make certain assumptions. In the first place, we never need to fear for nitrogen preparedness if we can continue to get nitrates from Chile. So the condition that we have to protect ourselves against is when nitrogen importations have been stopped, due to loss of free use of the seas.

That is our first assumption.

Then, in addition to your military requirements, you have to take care of the requirements of the fertilizer people and of the chemical industry, and I have made the assumption here that the by-product coke-oven capacity of the country would be adequate to take care of the fertilizer needs and of the chemical industry. They could only do it, however, by materially reducing the quantity of nitrogen that both the fertilizer people and the chemical people would consume. That could be done if we were fighting purely a defensive war, because we would not have to raise crops of one kind and another for the supply of foreign nations; we would only have to raise crops for the supply of America itself.

Then I have assumed that the No. 2 nitrate plant, which is very important from the standpoint of production of nitrogen, would be available, in stand-by condition. Of course, if it were operating at the time the war started it would be just that much more of a guaranty of nitrogen preparedness. Unfortunately, if we start to build a nitrate plant to-day you can not get the product of that nitrate plant in the form of munitions to troops at the front in less than about 22½ months, because you have to construct your nitrate plant, then you have to put it in operation and develop full operation, and then when you get the product it still requires 7½ months in order to convert it into munitions and deliver it to the firing line. This is because the nitrogen has to be sent to powder plants, or explosive plants, and there converted into powder and explosives, and then these have to be sent to assembling plants and put in the form of complete rounds of ammunition, and these latter in turn have to be tested, and then forwarded to the troops at the front, wherever they may happen to be.

So that it is the judgment of the Ordnance Department that we could not hope to make nitrate production equal nitrate consumption in less than about 22½ months after war was started.

As I said before, this bottom curve represents production we think we could get out of America of nitrogen in the form of munitions delivered at the battle front.

Therefore, if we are going to have adequate nitrogen preparedness, we must have on hand a stock equal to the maximum difference between our production curve and our requirement curve, and in this instance it amounts to 74,000 tons, even with the No. 2 nitrate plant in operation. As a matter of fact, that is approximately the amount of nitrogen that we have on hand. Part is in the form of nitrate of soda; it is in the form of smokeless powder; it is in the form of high explosives; it is in the form of ammunition.

But as we stand to-day in America, even with importations stopped, that stock of nitrogen would supply an Army that was raised and fought in about the same way that the World War Army was raised and fought.

You can see the big part that the No. 2 plant plays in the solution. It represents, during the first 22½ months of the war, over 75 per cent of the nitrogen

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which we would get from new production even with a standing start. If the plant were in operation, this curve would immediately swing up and you would still get the solution with lesser stocks of nitrogen. In other words, you could reduce the quantity of nitrate of soda that you are keeping. It was on that principle that the Ordnance Department recommended, provided the bill that was before the Agricultural Committee some two years ago passed, that the stocks of nitrate which had been held at 300,000 long tons should be reduced to 150,000 tons.

The CHAIRMAN. In other words, as I understand, it is reduced to this, that if nitrate plant No. 2 were ready to operate on a moment's notice and kept in that condition all the time it would be the same kind of a safeguard that we provide ourselves with by storing up a whole lot of explosives?

Major BURNS. That is correct; yes, sir.

The CHAIRMAN. So that instead of storing a lot of explosives, with that plant ready to operate on a moment's notice, you would avoid the storage of——

Major BURNS. That is correct.

Senator HEFLIN. It would release all this nitrate of soda that has been stored up for fertilizer purposes?

Major BURNS. Not all of it; but you could release its equivalent. It would have to be worked out on the principle I have endeavored to describe.

The CHAIRMAN. Now, Major, compare the expense of keeping this nitrate plant ready for operation, even if we should not operate it, but keep it in standby, as you put it——

Major BURNS. Yes, sir.

The CHAIRMAN. With the expense of keeping instead the amount of explosives that we have. That is a very expensive proposition, as I understand it, even the storage?

Major BURNS. That plant is just as good to us, in my judgment, as stocks of about 150,000 tons of nitrate of soda, and 150,000 tons——

The CHAIRMAN. How much would it cost to keep 150,000 tons of nitrate of soda?

Major BURNS. One hundred and fifty thousand tons of nitrate of soda, at the present market, are worth approximately $7,500,000.

Senator MCKINLEY. Does it deteriorate?

Major BURNS. No, sir. There is no deterioration. There is some loss. It is very slight, though, if properly stored. Nitrate of soda will absorb moisture so rapidly that some of it will run off unless you have practically watertight foundations to hold it.

The CHAIRMAN. Where do you keep it, and what does it cost to keep it?

Senator MCKINLEY. I will put it this way: What percentage is there of deterioration?

Major BURNS. There is no deterioration, but there might be a wastage of approximately one-half per cent per year.

Senator MCKINLEY. That would be one-half per cent per year on $7,500,000?

Major BURNS. Yes, sir.

The CHAIRMAN. Where is it stored and how is it stored, and what do you have to do to store it?

Major BURNS. As I said before, the big thing is to keep rain away. That is all.

The CHAIRMAN. Isn't it explosive and dangerous?

Major BURNS. No, sir. Nitrate of soda is not explosive.

The CHAIRMAN. How much are we paying now for rental where we store this stuff?

Major BURNS. We have none of our nitrate of soda at the present time in leased storage. So our expense is that of guarding and maintaining buildings in which the nitrate is stored.

The CHAIRMAN. You have to protect it from fire?

Major BURNS. Yes. It should preferably be of fireproof construction, because nitrate of soda, in the presence of anything that will burn, causes a very rapid fire.

The CHAIRMAN. If the building were burned, it would burn up?

Major BURNS. The building would burn up, but all the nitrate of soda would not burn.

The CHAIRMAN. It would not burn?

Major BURNS. No, sir. Part of it would, but only a part. It is only inflammable when in the presence of some inflammable material, or some material that would burn, like wood or things of that nature.

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The CHAIRMAN. If the building burned——

Major BURNS. It will burn so long as the wood is there to support combustion.

The CHAIRMAN. As soon as the wood was burned up it would stop?

Major BURNS. Yes, sir.

The CHAIRMAN. And the fire would go out?

Major BURNS. Yes, sir. It would not burn alone.

Senator MCKINLEY. What is the cost of storage?

Major BURNS. I could only give you a guess on that, Senator. I think that the storage charges per year, now that all nitrate has been removed from leased storage, are not very large. I should say that 150,000 tons could be stored at an annual charge of not in excess of $25,000.

The CHAIRMAN. I understood, Major, when we had this question up a couple of years ago, the testimony showed the storing of these nitrates was a very expensive proposition.

Major BURNS. At that time it was, Senator, for the reason that we had 300,000 tons of nitrate of soda then, and a large part of it—I think some 80,000 tons—were stored in leased storage, for which quite a high rental had to be paid. In the meantime the War Department has disposed of 80,000 tons of that reserve, or practically all that was in leased storage, and so that yearly rental has been eliminated.

The CHAIRMAN. Well, is it a dangerous proposition to dispose of that? Why was that done?

Major BURNS. The Secretary of War, in his judgment, thought that the stock could be reduced to 220,000 tons.

The CHAIRMAN. Did the fact that we had this nitrate plant have anything to do with that?

Major BURNS. I don't know what was in the Secretary's mind.

Senator MCKINLEY. You still had in storage 220,000 tons?

Major BURNS. Yes, sir.

The CHAIRMAN. The fact remains, however, that prior to that time they thought it necessary to keep a lot more in storage than they keep in storage now. Now, the question in my mind is why this change? Did this nitrate plant then having come into existence have anything to do with that?

Major BURNS. The nitrate plant has always been considered as a part of our nitrogen preparedness. Of course, I can not speak the Secretary's mind, but everything in military preparedness hinges upon the probable war Army that you are going to provide for. There never has been established in the United States a munitions policy based upon a probable war Army. It is just the judgment of the Secretary of War as to what provision should be made. Naturally he thought that if he kept 220,000 tons of nitrate of soda it would be sufficient for the probable war Army.

The CHAIRMAN. What I am trying to reach is why this change? Assuming the nitrate plant that we have now completed has nothing to do with it and had nothing to do with it, then our policy was wrong when we were keeping so much, apparently, or it is wrong now, when we have so little. One or the other must follow, it seems to me.

Major BURNS. Your conclusion would be absolutely correct, Senator, if we were always working to the same plan. But, as I said before, your war plan is a changeable proposition.

The CHAIRMAN. What caused the change by which you can get along with less storage of nitrate of soda now than before?

Major BURNS. I can not answer that.

Senator MCKINLEY. In the first place, Secretary Baker recommended an Army of half a million, and then the Army bill was passed providing for 220,000.

The CHAIRMAN. I don't think it had anything to do with our peace Army. The storage for this was in preparation for war.

Major BURNS. That is correct. The size of the peace Army has no connection with the solution of the question as to the amount of nitrates which you store for the war Army.

Senator MCKINLEY. Mr. Chairman, if you want to put into the record the cost of keeping that 150,000 tons, I have figured it out here.

The CHAIRMAN. All right.

Senator MCKINLEY. He said it would cost $7,500,000. Five per cent would be $375,000; one-half per cent wastage would be $37,500; for storage, $25,000, making $437,500 as the cost of keeping 150,000 tons.

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The CHAIRMAN. Now, this nitrate plant No. 2 is complete in every respect. It is modern in every way, backed up by a steam plant that can give power enough to operate it?

The CHAIRMAN. It is ready to start on a moment's notice as soon as you can build your fire under your boilers? Is not that true?

Major BURNS. Yes, sir.

The CHAIRMAN. Right now?

Major BURNS. That is correct; yes, sir.

The CHAIRMAN. If we complete these dams, or one of them, we will have that, in addition, as cheap power?

Major BURNS. That is correct; yes, sir.

The CHAIRMAN. So that whether we can make nitrates and get them out of the air from this plant in peace times for a sum that would be sufficiently low to supply fertilizer in time of peace, the fact remains that in time of war, if we were pushed to it and had war to-morrow, you would be able to immediately start this plant to work?

Major BURNS. That is correct; yes, sir. As we stand to-day on nitrogen, in my judgment we are sufficiently protected, even though importation stops, so that we could supply an Army that was raised as rapidly as our World War Army was raised and fought at a more rapid rate. In the World War we did not start fighting so rapidly as we would have to in a defensive war, because our battle front was some 5,000 miles away from America, and, as a consequence, it took a long time to transport troops that distance and put them on the firing line. But we are protected only provided that we retain No. 2 plant at least in stand-by. If the No. 2 plant is operated we would get additional protection; and you could bring yourself back to the same quantity of protection in this case by disposing of some of your stocks of nitrate of soda.

The CHAIRMAN. How much additional security, if any, is added to that by nitrate plant No. 1, assuming that you would spend $5,000,000 and take out that machinery that is no good and put in modern machinery?

Major BURNS. Well there would be an appreciable increased protection from two standpoints. One would be that our protection curve would be raised, because there would be additional capacity.

The CHAIRMAN. How much more?

Major BURNS. You would have at least 20 per cent more, because that plant is one-fifth of the No. 2 plant. But over and above that you would have a greater amount of knowledge in America that could be applied to the construction and operation of nitrate plants and that undoubtedly would have the effect of further increasing production. That would be a matter of judgment. I do not know how much it would be, but I think it would be greater than even the 20 per cent.

Senator HEFLIN. How much would these two plants, when completed and in operation, lack of supplying us with the nitrate that we need?

Major BURNS. In time of war?

Senator HEFLIN. Yes.

Major BURNS. Those two plants would give you sufficient nitrogen for about 14 divisions of an army.

The CHAIRMAN. How many men?

Major BURNS. A full division has about 35,000. It would be fourteen times 35,000.

Senator MCKINLEY. Half a million?

Major BURNS. Yes; about half a million.

As an indication of the importance, from that point of view, I would like to say, in the Meuse-Argonne offensive, which was the maximum military effort of the United States in the World War, we had either on the battle front or in reserve so that they could be put on the battle front, about 30 divisions. So, these two plants would give you nitrogen preparedness for about half the divisions we were able to put into the World War.

The CHAIRMAN. Where would we get the balance from?

Major BURNS. You would have to get the balance by building new plants and pending the time when the new plants would come into use you would use your reserve stock.

Senator NORBECK. Are there not now commercial plants manufacturing nitrogen?

Major BURNS. Yes, sir.

Senator NORBECK. What is their capacity?

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Major BURNS. There is at Syracuse the plant of the Air Nitrates Corporation, which is the only plant of any appreciable importance. The Nitrogen Products Co. has a very small plant which uses the arc process, and is located in the State of Washington.

Senator MCKINLEY. Is this 100,000 tons a year of by-product nitrogen available?

Major BURNS. It would be available, but in my judgment you could not depend upon it for military purposes. You would have to turn that over to the fertilizer industry and to the chemical industry. As you know, all of the domestic explosives in America are made from nitrogen. Of course, you can not curtail such production in time of war, because they are of as much importance, if not more, in time of war than in time of peace.

The CHAIRMAN. Then, Major, as I understand it, to get down to a practical proposition, these nitrate plants we own now in Alabama as a war proposition entirely, are justified, in your judgment?

Major BURNS. Yes, sir.

The CHAIRMAN. Not only justified, but it is practically necessary for us to keep them in condition so that they can be operated as a matter of war preparation?

Major BURNS. In my judgment that is true with reference to the No. 2 plant. I do believe, however, that we have adequate nitrogen preparedness even though the No. 1 plant were disposed of. If the No. 1 plant were perfected and made available for operation you would have just that much additional preparedness.

The CHAIRMAN. In case of war now, from your testimony as I understand it, we would have to build additional nitrate plants?

Major BURNS. That is correct; yes, sir.

Senator KENDRICK. Major, would it not be necessary to operate them at least part of the time to keep them in condition?

Major BURNS. I have no doubt but what that is so, Senator, because we do not know how long that No. 2 plant will remain ready for operation in case we do not turn it over.

The CHAIRMAN. Let me ask you this, Major:

The completion of dams Nos. 1 and 2 only adds to this war preparation by making it more economical. It not that true?

Major BURNS. No; that is not wholly true.

The CHAIRMAN. To what extent is it true?

Major BURNS. Because it took the Government longer to produce power in this war than almost anything else. We had the chemical plant at Muscle Shoals ready for operation long before the steam power plant at Muscle Shoals was ready. The chemical plant was not ready, however, before the Gorgas plant that the Alabama Power Co. constructed was available. If the Wilson Dam were completed you would have, in round figures, an additional 200,0000 horsepower, which would allow you to operate two plants additional to the No. 2 plant, and it would give you, from a power standpoint, very much greater preparedness.

The CHAIRMAN. That is leading up to what I want to raise.

We would be justified as a war proposition, therefore, as I understand your testimony, in completing Wilson Dam?

Major BURNS. Absolutely.

The CHAIRMAN. Even though we never use it in time of peace?

Major BURNS. Absolutely; yes, sir. There is no question about it.

The CHAIRMAN. And we are justified in maintaining nitrate plant No. 2, together with the steam power with which to operate it, that we have there, and keeping them in prime condition, even though we got nothing out of them absolutely, except in time of war?

Major BURNS. Yes, sir.

The CHAIRMAN. Taking those assumptions as true, having a power developed at Wilson Dam and having the machinery there to manufacture nitrates, would we not be justified, then, in using them in time of peace, assuming that we do not injure them in any way, and use would not injure them, as I understand it——

Major BURNS. No; use would help them.

The CHAIRMAN. It would help them. Then would we not be justified in using them, for instance, to make fertilizer, without considering any capital cost whatever, and if by the use of the power and the use of the plants we could make fertilizer that would compete with the present market price, and

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consider nothing except operating cost, would we not be justified in doing it in time of peace?

Major BURNS. From a preparedness standpoint you would unquestionably be justified; yes, sir.

The CHAIRMAN. Now, if we did not figure any cost except the additional machinery that it would be necessary to put in, that is of no use in time of war but would be useful to make fertilizer, consider only that, and we manufacture fertilizer, how cheaply could we make fertilizer, assuming that our Wilson Dam has cost us nothing, because we have got that anyway, and we are going to have that anyway if we carry out your theory, as a war proposition. Then base your calculation for fertilizer entirely on cost of operation and on cost of the necessary machinery that you would have to put in in addition to what you have there to make fertilizer?

Major BURNS You are going to charge your hydroelectric power up to just operating expenses only?

The CHAIRMAN. Just operating expenses only.

Major BURNS. I imagine that would be about a quarter of a mill per kilowatt-hour, would it not, Colonel Barden?

Colonel BARDEN. I will figure it out.

The CHAIRMAN. Let me ask you, in your judgment, what is wrong, if anything, with my assumption? Is there anything wrong with it?

Major BURNS. From the military standpoint only there is nothing wrong.

The CHAIRMAN. If for military purposes we are going to have this dam, we are going to continue this machinery just as we have it now, just keep it there ready for use on a moment's notice, and all this power going to waste, doing nothing with it, would we not be justified and, as a matter of fact, as long as we do not injure that property but, as you say, improve it, for the purpose of doing some useful act—and I am assuming that making fertilizer would be such useful act, or you could take anything else, but for the purpose of this question I am taking fertilizer—would we not then be justified in not charging up against the cost of fertilizer anything as to the cost of the Wilson Dam or anything as to the cost of this machinery or its upkeep, because we have to keep that up anyway as a military proposition?

Major BURNS. Of course, you are getting into the problem of economics now that hardly feel qualified to discuss, because if the Government builds that large power plant and then gives the power at practically zero——

The CHAIRMAN. Yes.

Major BURNS. For use in the manufacture of fertilizer, you are undoubtedly creating what you might term an interior subsidy in the matter of fertilizer production, and you would undoubtedly hurt a great many fertilizer companies that have spent lots of money in their business.

The CHAIRMAN. Of course, that is a question of policy on which the military——

Major BURNS. We would not be in on that at all.

The CHAIRMAN. Would have no authority to act. But whether we would injure any fertilizer company engaged in producing would depend on how cheaply we made this.

Major BURNS. Yes, sir; it would.

The CHAIRMAN. It would not necessarily follow that we would injure any of the fertilizer companies. But suppose it was demonstrated that there was a sort of a trust in the fertilizer business, and realizing that agriculture must have fertilizer—and even in time of war we have to produce food or we can not live—and the Government went into it to the extent not to drive anybody out of business, but would charge enough for it so as to let everybody else live if they were doing an honest, legitimate business, then your criticism would not apply, would it?

Major BURNS. No, sir.

Senator MCKINLEY. Suppose somebody came along and offered you a million dollars a year for your power.

The CHAIRMAN. It would be a question that we would have to consider as to whether it would be better to take that money or whether we should do like they do in Australia. When the Government there finds any bunch of fellows are monopolizing anything and charging exorbitant rates, they simply go into the business themselves, not to drive others out but just to regulate them, and they claim they regulate them cheaper than we do by laws.

Senator HEFLIN. It is claimed, Mr. Chairman, if Mr. Ford makes fertilizer at Muscle Shoals, the competition that he may bring against those who already

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manufacture it would cause a saving of a hundred million dollars a year to the farmers of the United States. If that is so, I think the Government would be justified in having fertilizers made rather than selling the power for a million dollars.

The CHAIRMAN. Of course, that would be a question of policy as to whether we would better sell it to somebody or make fertilizer, or something else.

Senator MCKINLEY. Suppose you were able to make fertilizer there at $50 a ton. I was just wondering how you would save the hundred million dollars, if we made $5,000,000 worth of fertilizer?

Major BURNS. You could make about 200,000 tons of ammonium sulphate at United States nitrate plant No. 2, which is the fertilizer item.

Senator HEFLIN. How many tons of fertiliezr?

Major BURNS. That plant would supply the nitrogen only.

Senator MCKINLEY. You have to have other ingredients. It is made out of blood and things from the Beef Trust.

The CHAIRMAN. If we wanted to sell this power to somebody else to use in time of peace, we would always have to put in the contract that the contract would terminate immediately in time of war or when the President or other officials thought that there was danger of war?

Major BURNS. Yes, sir.

The CHAIRMAN. And we could not expect any private person or corporation to pay the same price for this power that we would turn over to them with that kind of a stipulation in the contract as we could if we had a definite period of years that we could sell it, because it might happen that they would be right in the middle of some important development and the entire power would be taken away from them.

Major BURNS. Of course Congress has answered that problem, I think, very well. I think the national defense act allows the War Department to commandeer any plant that is necessary——

The CHAIRMAN. Oh, yes.

Major BURNS. I think when you do commandeer you have to pay the necessary damages to the party controlling the plant.

The CHAIRMAN. We might have to. If we would do as suggested by Senator McKinley, instead of utilizing this, for instance, by the Government, to make fertilizer, we sold it, leased it to somebody, and they gave us a hundred million dollars, we might have to pay them more damages if we cancelled that contract, than we were getting, and, as a matter of fact, it might mean greater damages to the person who got it, and it might be that they were perfectly honest and honestly entitled to damages.

Major BURNS. Yes, sir. That would depend on the conditions.

Senator KENDRICK. What proportion of the primary power at Muscle Shoals would be required to run that Muscle Shoals plant?

Major BURNS. We would use practically all of the primary power of Wilson Dam to run that plant if we operated with primary power, but it is my judgment that No. 2 plant can be operated economically with the first 100,000 of secondary horsepower.

Senator KENDRICK. It could?

Major BURNS. Yes, sir.

Senator KENDRICK. That would leave nearly all of the primary power available for commercial use?

Major BURNS. Yes, sir.

The CHAIRMAN. In other words, you would utilize the steam plant to help out the secondary power?

Major BURNS. Not necessarily. I really believe that the steam power plant ought to be considered as a part of the Wilson Dam. Then I think the cyanamid plant can well take its power from a combination of the Wilson Dam and the steam power plant No. 2; and I believe that the big bulk of the work at the cyanamid plant could be done with the first 100,000 of the secondary power. There would be a portion of the work that would have to be taken care of by primary power.

The reason I think that can be done is this: Over 90 per cent of all the power consumed in the cyanamid process is used in the calcium carbide part of the plant, and up to that part of the plant you only use about one-third of the labor. So that if you used secondary power to include the carbide part and used primary power from there on you would use cheap power, and at the same time you would not have any great burden from the lay off of men.

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The CHAIRMAN. You would not be able to operate all the time, though, would you?

Major BURNS. You could, at an average yearly production rate of 80 per cent of the capacity of the plant. You would have to put up some storage warehouses to take care of the calcium carbide, and that would, in turn, feed the rest of the plant during the remainder of the 12 months of the year.

The CHAIRMAN. That makes it perfectly plain. It would mean that the making of the calcium carbide part of it would be suspended part of the time?

Major BURNS. Yes, sir; that is correct.

The CHAIRMAN. But when you were making that you could make it faster than the balance of the plant could utilize it, so you could store it up.

Major BURNS. Yes, sir.

Senator MCKINLEY. You believe you could do that for 10 months of the year?

Major BURNS. Yes, sir.

The CHAIRMAN. Colonel Barden, have you got those figures?

Colonel BARDEN. I was just figuring on the primary power on the same basis as I figured the other day. The operation of the steam plant at nitrate plant No. 2 to convert a portion of the secondary power of the dam into primary power makes a total of 167,300 horsepower per year primary power, and all of the secondary power going in for nothing. On that basis it would be about a little less than 2 mills per kilowatt hour, omitting the 4 per cent interest.

The CHAIRMAN. The question I propounded, Colonel, to Major Burns was this: Assuming, now, from the standpoint of the manufacture of fertilizer, the power at the Wilson Dam costs nothing; that the only expense is the expense of installing necessary machinery that must be used to make fertilizer as distinguished from explosives, then how cheaply could you make fertilizer?

Colonel BARDEN. In the figures I used the other day I assumed that the annual cost of operation of the dam is 9 per cent, of which 4 per cent was interest on the money put in it and 5 per cent was actual cost of operation, depreciation, and obsolescence of the plant. So if I correctly understand your question now, all that I could cut out of that estimate would be the 4 per cent for interest and the 5 per cent——

The CHAIRMAN. Why not part of that 5 per cent for obsolescence that would take place if you did not operate the plant anyway; and if so, how much of it?

Colonel BARDEN. I would have to know how you wanted me to figure it in order to give a correct answer.

The CHAIRMAN. The point I want to reach, Colonel, is this: Assuming, as from the testimony of Major Burns I do assume, that we are going to maintain this plant No. 2 and the steam plant connected with it, and the Wilson Dam; assuming we are going to maintain all those things as a war proposition, we are going to keep them in such condition all the time so that we could start up immediately; now, then, utilizing that power and that machinery——

Senator HEFLIN. While it is idle.

The CHAIRMAN. While it is idle, for making fertilizer; the only cost you have to add to it now is the necessary machinery, which I understand is quite a little item, of installing fertilizer machinery as distinguished from the other machinery that is there now; then what would it cost to make fertilizer?

Colonel BARDEN. Well, I could only give you the cost of power.

The CHAIRMAN. Well the cost of the power?

Colonel BARDEN. You would have to operate the steam plant for a certain portion of the year, of course, if you assume that the dam would be maintained, under any circumstances.

The CHAIRMAN. I do. I assume that.

Colonel BARDEN. Then I assume that the cost you would want to charge to the fertilizer would be only the cost of operating the steam plant a portion of the year.

Senator KENDRICK. And operating the fertilizer plant under secondary power? Is that the idea?

The CHAIRMAN. No. I want to use the primary power.

Senator MCKINLEY. You have to use your steam power. You have to operate your turbines and dynamos.

Major BURNS. No. 2 nitrate plant can be operated practically all the time without the steam plant, with power from Wilson Dam.

The CHAIRMAN. Yes.

Major BURNS. So that would immediately eliminate any discussion of the steam plant.

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The CHAIRMAN. You could do that with the fertilizer. You would not need to use the steam plant at all.

Major BURNS. No, sir.

The CHAIRMAN. Your power to make fertilizer would really cost you nothing, would it?

Colonel BARDEN. Just the additional expense of operation over what would be the expense of maintenance——

The CHAIRMAN. Yes, sir.

Colonel BARDEN. And I presume that would be perhaps not over $100,000 a year.

The CHAIRMAN. That would pretty nearly reduce your——

Colonel BARDEN. Your power would be a very small amount.

The CHAIRMAN. That would put it down to less than one-tenth of a mill, wouldn't it?

Colonel BARDEN. It would be almost negligible.

Senator MCKINLEY. The trouble is you would have somebody coming along and making an offer of about 2 mills for the power.

The CHAIRMAN. Yes; I know that.

Senator MCKINLEY. And then you would have to answer that.

The CHAIRMAN. And maybe you would have to accept that. But you would always have to consider, Senator, when they made that kind of an offer, that you would have to reserve the right to cut that contract off at a moment's notice, consequently they would not be able to pay you the commercial price.

Senator HEFLIN. We are trying to get what it would cost to produce fertilizer under those conditions.

Major BURNS. I can calculate that and show you the basis of the calculation and submit it for the record.

(The estimate follows:)

ESTIMATES OF COST OF PRODUCING NITROGEN FERTILIZER MATERIALS AT UNITED STATES NITRATE PLANT NO. 2.

These estimates do not include any allowance for interest on capital, depreciation, and obsolescence, or taxes and insurance. Additional capital of some $10,000,000 would be required to convert the No. 2 plant into a fertilizer plant and to operate it as such.

I. Ammonia.[1]

Material.	Quantity per ton of ammonia.	Unit cost.	Cost per ton of ammonia.
Power	11,432 kilowatt-hours	$0.001	$11.43
Limestone	7.05 tons	1.25	8.81
Coke	2.17 tons	6.00	13.02
Coal	0.84 tons	4.00	3.36
Electrodes	152.15 pounds	.05	7.61
Soda ash	0.134 ton	25.00	3.35
Steam	8,000 cubic feet	.285	2.28
Repair parts			5.14
Miscellaneous materials			6.36
Labor			33.74
Plant overhead (superintendence, office force, fire and police protection, etc.).			12.00
			107.10
Royalties:			
American Cyanamid Co.[2]			24.70
Air Reduction Co.[3]			2.24
			26.94
Total cost per ton			134.04

[1] No charge is included for shipping containers or sales expenses, as it is not assumed that ammonia would be sold as such.

[2] In accordance with contract, royalties of American Cyanamid Co. amount to $30 per ton of nitrogen fixed, but are subject to arbitration upon request of either party.

[3] Royalty to Air Reduction Co. until January, 1931, is $2.72 per ton of nitrogen fixed; after that date there is no royalty charge.

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II. Ammonium sulphate.[1]

Material.	Quantity per ton of sulphate.	Unit cost.	Cost per ton of sulphate.
Power	2,972 kilowatt hours	$0.001	$2.97
Limestone	1.82 tons	1.25	2.27
Coke	0.558 ton	6.00	3.35
Coal	0.218 ton	4.00	0.87
Electrodes	39.2 pounds	0.05	1.96
Sulphuric acid	0.96 ton	10.00	9.60
Miscellaneous materials			5.20
Labor			12.01
Plant overhead (superintendence, office force, fire and police protection, etc.).			4.50
Bagging (assuming 65 per cent shipped bulk)			.50
Total			43.23
Royalties:			
American Cyanamid Co.[2]			6.18
Air Reduction Co.[3]			2.62
Total			8.80
Total cost per ton			52.03

[1] No charge is included for sales expense.
[2] In accordance with contract royalties of American Cyanamid Co. are subject to arbitration upon request of either party.
[3] Royalty to Air Reduction Co. discontinues after January, 1931.

Sulphate of ammonia is the material which with present knowledge could be produced to the best advantage for use in fertilizer. Chilean nitrate contains 15 per cent of nitrogen and sulphate of ammonia about 20 per cent, and the prices of the two materials are ordinarily proportionate to the nitrogen they contain. Chilean nitrate at $50 per ton is about equivalent to sulphate of ammonia at $66.60 per ton.

The CHAIRMAN. All right.

Major BURNS. But it would cost approximately $48 per ton of ammonium sulphate, even though the power costs nothing.

Senator HEFLIN. How many tons of fertilizer would that make?

Major BURNS. That would produce about 200,000 tons of ammonium sulphate, which would, in turn, give you the nitrogen content only for some 2,000,000 tons of fertilizer.

Senator HEFLIN. Out of that 1 ton?

Major BURNS. No; out of the whole.

Senator HEFLIN. I asked you how many tons of fertilizer would be made out of that 1 ton?

Major BURNS. It would be fifty times that.

Senator MCKINLEY. Not of ammonium sulphate?

Major BURNS. No, sir. The Senator understands that fertilizer includes phosphoric acid, potash, and nitrogen. The percentage of nitrogen in complete fertilizer is approximately 2 per cent only.

Senator HEFLIN. So this 1 ton you use would produce 50 tons of fertilizer? You said fifty times that?

Major BURNS. That is wrong. It would be ten times.

Senator HEFLIN. It would be 10 tons, then?

Major BURNS. It would be the nitrogen for 10 tons of fertilizer.

The CHAIRMAN. Major, is it your judgment that the Government ought to scrap nitrate plant No. 1?

Major BURNS. Yes, sir.

The CHAIRMAN. You think it ought to be done?

Major BURNS. Yes, sir; unless the Government is going to continue the development for the purpose of developing fertilizers. We are prepared, from a war standpoint, without the development of nitrate plant No. 1.

The CHAIRMAN. Now, I asked you that question as a preliminary to what you have almost answered now that I have in mind. Notwithstanding the fact that you think that ought to be scrapped, you do believe, from your investigation and your knowledge of the chemical situation, that the prospect for improve-

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ment in the making of fertilizer or explosives lies rather in the Haber process than in the cyanamid process?

Major BURNS. Yes, sir.

The CHAIRMAN. Now, then, we ought to be just as anxious to improve a method of making fertilizer for war as for peace, ought we not?

Major BURNS. There is quite a difference between the two.

The CHAIRMAN. I know there is, but if we want to make it as cheaply as we can, whether it is during war or peace, we ought to do that to save as much money as we can?

Major BURNS. Yes, sir; that is true.

The CHAIRMAN. If the Haber process is the one that seems to offer to the scientific men a road to economy in the manufacture of nitrate, why should we scrap it and throw it away?

Major BURNS. The Ordnance Department would not be in favor of it at all except for the fact that the Atmospheric Nitrogen Corporation has satisfactorily developed the Haber process at their Syracuse plant, so that process is an established fact in America, and if we had to duplicate plants we could use their organization and their knowledge for the construction of the Haber process.

The CHAIRMAN. Your theory is, then, that private parties have gotten hold of that——

Major BURNS. And have done what we set out to do.

The CHAIRMAN. That through our work down there we have enabled private parties or corporations to go ahead and make a success of it?

Major BURNS. Yes, sir.

The CHAIRMAN. And you think we could depend on that for our supplies?

Major BURNS. Yes, sir; that is correct.

Senator KENDRICK. Major Burns, I wanted to ask you another question about this power.

I understood you to say it would be more satisfactory and even more economical in the maintenance of that cyanamid plant if it were operated at least part of the year than to allow it to stand in idleness?

Major BURNS. Yes, sir; I think that is true.

Senator KENDRICK. Then, assuming that the Government would want to operate it, it would find it possible to do so without any obligation to keep it going any particular length of time, would it not? Suppose it was producing fertilizer, it could discontinue operations at any time it wanted to do so, and not violate any contract with anybody?

Major BURNS. In my judgment it could; yes, sir.

Senator KENDRICK. Under those circumstances, would it not be a great deal the most economical way to dispose of the primary power of that dam and to use in large measure the secondary power in the production of fertilizer; and, at the same time, it would be more economical and more satisfactory for the Government to do that, because of the fact that it could suspend operations without regard to obligations?

Major BURNS. I think that would be a very good solution of the problem, namely, to use the primary power for industrial purposes, and use the secondary power for the time being, at least, for the operation of that plant.

Senator KENDRICK. Yes. In other words, manufacturing, commercial enterprises, would not care for the secondary power so much, because it is uncertain; but it would fit into the Government's plans almost as well as the primary power?

Major BURNS. Yes, sir; I think that is true.

Senator KENDRICK. And prove a highly economical use?

Major BURNS. Yes, sir; that is true.

The CHAIRMAN. Now, Major, what about the nitrates that we use for the Army and Navy in time of peace? Would that be sufficient to be taken into consideration?

Major BURNS. No, sir; it is not much.

The CHAIRMAN. It is too small?

Major BURNS. Yes, sir.

Senator HEFLIN. Major, suppose you would charge the money invested in nitrate plants at Muscle Shoals to war purposes and the money invested in building a dam for creation of power for war purposes, and you undertook the manufacture of fertilizer, as the chairman stated in the outset, without figuring any cost of construction at all, can we produce fertilizer in competition with commercial fertilizer?

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Major BURNS. The margin is very slight between sulphate of ammonia produced in the No. 2 plant and commercial fertilizer. As I told the chairman, I think you could manufacture ammonium-sulphate for about $48 a ton without usual overhead charges and with power costing nothing. The present market price of ammonium sulphate is some $55 to $60 a ton.

Senator HEFLIN. You could certainly produce that in competition?

Major BURNS. I have not included in that any charge against capital. Now, you have to include additional capital in order to make a fertilizer plant of it. You would have to spend probably $10,000,000 for the rounding out of the No. 2 plant so that it would be a fertilizer plant. The interest charges on that sum might amount to a dollar or two a ton.

Senator MCKINLEY. It would amount to $5, would it not, if you count the earning power? Five per cent of 10,000,000 is 500,000, and you would make 100,000 tons?

Major BURNS. No; it would be 200,000 tons of sulphate. On that basis the interest charges would be $2.50 per ton.

Senator HEFLIN. Would not that annual production have a very good effect in bringing down the price of commercial fertilizer?

Major BURNS. I don't think it would affect the price very much at the present time, but, as I stated yesterday, it would have the effect of stabilizing it, because it would eliminate some of the peaks in prices which come along from time to time.

Senator HEFLIN. Which would benefit the farmer who has to buy it?

Major BURNS. Yes, sir. It was only two years ago, when we were before the committee before, that ammonium sulphate was selling at $150 a ton. During this depression it got down to about $40 a ton. At the present time it is up to $55 to $60 a ton. Its average pre-war price was about $60 a ton.

Senator HEFLIN. If the Government should produce fertilizers there, or Mr. Ford should produce fertilizers there, and the Government should find out how much it cost to produce them, would not that enable the Government to regulate the Fertilizer Trust in the United States and get at the matter of what it costs to produce it and what sort of profit ought to be permitted?

Major BURNS. It would assist slightly, but I would like to make this statement, Senator, that the question of the Fertilizer Trust has been before the public for a long while, and I believe it was in accordance with some bill passed by Congress that an investigation of the Fertilizer Trust was made along about 1913 or 1914. As a result of that investigation, as I recall, the investigators felt that the fear of the Fertilizer Trust was more or less unfounded, and that the fertilizer people were playing a fair game; they were not making undue profits. They were, however, carrying on certain practices that received slight condemnation. They had many brands of fertilizer that were all about the same, but they were marked differently, and they had the effect of fooling a great many people, because a farmer would learn of a certain brand of fertilizer and he would always want it, and it only. Another brand that was of exactly the same chemical composition but of a different name he would not take, because he had tried out the first and it worked satisfactorily, and he might have tried out the second under conditions which were not quite so favorable, and he did not get as good results. He always thought the Black Hawk fertilizer—if that happened to be the brand—was the very best in the world.

Senator HEFLIN. If that committee found there was no Fertilizer Trust, it had been hypnotized.

Major BURNS. I don't know about that, sir. It was the Federal Trade Commission.

Senator MCKINLEY. Probably Wall Street had something to do with it.

Senator HEFLIN. Wall Street has a hand in everything.

Senator KENDRICK. Mr. Chairman, I want to ask the witness what rate of interest the primary power of this dam, if sold at a commercial rate, would return on the total cost of the dam?

Major BURNS. I could figure that out and submit it.

Senator KENDRICK. Colonel Barden, have you an answer to that question?

Colonel BARDEN. I have a statement here about that somewhere. I made the statement that if the dam was completed with the eight-unit installation——

The CHAIRMAN. That would be how many horsepower?

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Colonel BARDEN. That would be 240,000 horsepower. That if the primary power were sold on a 60 per cent load factor at 3 mills per kilowatt hour, and the secondary power sold on the same load factor at 1.16 mills per kilowatt hour——

Senator KENDRICK. Which would be about the commercial rate?

Colonel BARDEN. Well, yes. That the total annual income would be $1,542,500, which is approximately 7 per cent on the $23,177,000 which we estimated would be the cost of completion.

Senator KENDRICK. To complete the dam?

Colonel BARDEN. To complete the dam; yes, sir.

Senator KENDRICK. And do you recall, offhand, what the investment in the dam is up to this time?

Colonel BARDEN. The total investment would be, including what is already in, and what it would cost to complete it, in round figures $45,000,000; and this would be only about 3 per cent, or between 3 per cent and 4 per cent on that figure.

Senator KENDRICK. The total cost of power is somewhat higher, and that would bring the income on the investment in the dam up to about 4 per cent or 5 per cent?

Colonel BARDEN. My feeling is, Senator, that if Dam No. 2 were completed by the Government and the power sold, it would yield a return of probably certainly 4 per cent on the cost of completion, and that in the course of 10 or 15 or 20 years, as the demand for power increased and the price of power would probably increase, we could not only pay a rate of interest on the money spent to complete it, but also some interest on the money that is already in it.

Senator KENDRICK. And, in addition to that, based on the statement just made by Major Burns, would it not be possible, for instance, for the Government to have sufficient secondary power to go on and manufacture nitrates to meet the needs of the Government and for fertilizer purposes as well?

Colonel BARDEN. Well, sir, of course my figures were based on the assumption that the secondary power would be sold.

Senator KENDRICK. You only figure on 250,000 altogether?

Colonel BARDEN. Yes sir.

Senator KENDRICK. Now, as I understand it, there would be very much more secondary power for a great part of the year?

Colonel BARDEN. Yes, sir. It is hard to say what will happen in the future. We feel that the demand for power in the southern territory in the next five to seven years would be sufficient to use all the power, absorb all the power that would be developed at this dam.

Senator KENDRICK. Without regard to the secondary power?

Colonel BARDEN. We would expect to operate the steam plant if necessary to convert a portion of the secondary power into primary, and probably additional secondary power could be sold to other concerns that had steam plants of their own.

Senator KENDRICK. Do you happen to recall or have in mind what that secondary power amounts to and during what period of the year it is available?

Colonel BARDEN. Yes, sir.

The CHAIRMAN. I think that is all in the record.

Senator KENDRICK. Well, I have not found it possible to be here all the time, and I did not happen to be here when that testimony was given. I would like to have that information.

Colonel BARDEN. I have figured 87,300 as the primary horsepower, and then 141,000 horsepower available for 10 months of the year; 205,000 horsepower available for 8 months of the year; 305,600 horsepower available for 6 months of the year, and 600,000 horsepower available for 2½ months.

Senator MCKINLEY. That is all in the record.

The CHAIRMAN. Now, Major Burns, you have given it as your judgment that the Government ought to scrap nitrate plant No. 1, because the process has been developed and brought to such a stage of development that the Government could go ahead and manufacture by it in case of need.

Major BURNS. Yes, sir.

The CHAIRMAN. Now, nitrate plant No. 2 has been developed to be a success and in good shape all the way through?

Major BURNS. Yes, sir.

The CHAIRMAN. Why don't you scrap that also?

Major BURNS. Because, as I tried to show you from the curves, in order to meet our war demands we must have a sufficient quantity of stock plus facilities. The No. 2 plant is a very important facility and has a very great poten-

tial value for producing fixed nitrogen. The No. 1 plant, as it stands to-day, has no——

The CHAIRMAN. You would have to put some improvement on it?

Major BURNS. Yes, sir. You would have to put in about $4,000,000.

Senator MCKINLEY. It has scrapped itself. Is not that right? It is not a workable plant?

The CHAIRMAN. Oh, no; it is not entirely scrap. It has about $13,000,000 worth of machinery in it, but about $5,000,000 would have to be scrapped. Is not that right?

Senator MCKINLEY. No.

Major BURNS. Putting it another way, it would cost about $4,000,000 to make that plant work, as we figure it.

The CHAIRMAN. Yes; well, I have figured it at five million.

Major BURNS. And the plant cost $13,000,000.

Senator MCKINLEY. Oh, well, that is different.

Major BURNS. But the reason that the War Department does not argue for that No. 1 process is that that process is a developed commercial enterprise in America to-day.

The CHAIRMAN. So is the other one.

Major BURNS. There is no other cyanamid plant in the United States.

The CHAIRMAN. No; that is true, but I assume the reason it is not developed commercially is because scientific men do not regard it as of merit commercially as compared with the Haber process. Is not that true?

Major BURNS. I think that is partially true.

Senator HEFLIN. Major, I think you said the other day that the majority of this machinery in plant No. 1 could be used for power purposes, as Senator McKinley suggested when we were down there.

Major BURNS. That is correct. I said in order to make that No. 1 plant work you would have to spend about $4,000,000. You would not have to scrap all you have down there. Many features of the plant you would not have to touch at all. For instance, the plant for producing nitric acid, the plant for concentrating nitric acid, the plant for making ammonium nitrate are all right. You would not have to touch them at all.

Senator HEFLIN. How much is that worth?

Major BURNS. About $6,000,000.

Senator MCKINLEY. Now?

Major BURNS. That is what it cost.

Senator MCKINLEY. Not what it cost. We ought to throw away a lot of it and charge it up to the war.

Major BURNS. I can not tell you what it is worth. That is what it cost.

Senator HEFLIN. That part, you say, is worth $7,000,000, of which one-half would not have to be changed at all?

Major BURNS. No, sir; the plant would be of no use to you as a fertilizer plant unless it was modified.

Senator HEFLIN. Major, when Dam No. 3 is completed, the Wilson Dam, and No. 1 is put in running order, the cyanamid plant completed and the Haber plant, how much money will have been expended thereon?

Major BURNS. It would take $23,000,000 to complete No. 2 dam, as I understand it.

Senator HEFLIN. Wilson Dam?

Major BURNS. It would take $25,000,000 to complete No. 3 dam. You have got to add the No. 1 dam.

The CHAIRMAN. No.

Major BURNS. You did not mention No. 1?

Senator MCKINLEY. He meant No. 1 plant, the $4,000,000 for that.

The CHAIRMAN. He does not mean No. 1 dam. That is entirely a navigation plant.

Colonel BARDEN. The cost of Dam No. 2 is $28,000,000?

Major BURNS. $28,000,0000.

Colonel BARDEN. That is for eight units.

Major BURNS. That would be twenty-eight plus twenty-three plus four, or $55,000,000.

Senator HEFLIN. Then, with the plants added to that, what will the Government have expended then?

Major BURNS. $160,000,000.

Senator HEFLIN. $160,000,000?

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Major BURNS. Yes, sir.

Senator HEFLIN. Now then, Mr. Chairman, it is claimed that the power that would be produced there would mean a saving of 6,500,000 tons of coal annually, and that at $3 per ton that would be $19,500,000. In three years $57,500,000 worth of coal would be saved, and at $100,000,000 a year in fertilizer saved to the farmers in the price of fertilizer, would be $300,000,000 additional. So there is three hundred and fifty-odd million dollars saved, and the Government will have expended how much did you say?

Major BURNS. $160,000,000.

The CHAIRMAN. We will adjourn at this time until 10.30 o'clock Monday morning.

(Whereupon at 11.45 o'clock a. m. the hearing was adjourned to 10.30 o'clock a. m., Monday, April 17, 1922.)

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MUSCLE SHOALS.

MONDAY, APRIL 17, 1922.

UNITED STATES SENATE,
COMMITTEE ON AGRICULTURE AND FORESTRY,
Washington, D. C.

The committee met, pursuant to adjournment, at 10.30 o'clock a. m., in room 224, Senate Office Building, Senator George W. Norris (chairman) presiding.

Present: Senators Norris, McKinley, Capper, Gooding, Ladd, Norbeck, Harreld, Kendrick, Harrison, and Heflin.

The CHAIRMAN. The committee will come to order.

We were to start in with the Alabama Power Co. proposal this morning, I believe.

Senator HEFLIN. Mr. Chairman, Mr. Martin is here. I suppose he wants to be heard, or he will state the names of those that he desires to speak.

The CHAIRMAN. All right, Mr. Martin.

STATEMENT OF MR. THOMAS W. MARTIN, PRESIDENT ALABAMA POWER CO., BIRMINGHAM, ALA.

Mr. MARTIN. Under date of February 15, 1922, the Alabama Power Co. submitted an offer to the Secretary of War by which the Wilson Dam at Muscle Shoals might be completed, and the nitrate problem of the Government in connection therewith simplified without further advances or expenditures by the United States. That proposal, accompanied by a letter of explanation from this company of its plan, was in turn submitted by the Secretary of War to the Congress on February 21, 1922.

I understand, Mr. Chairman, that I am to take up the merits of this proposal as presented by the Alabama Power Co.

The CHAIRMAN. Well, Mr. Martin, would it not be well at this point in your testimony to put in the record your written proposal and the recommendation also? I would suggest that you put them in.

Mr. MARTIN. I will offer here the letter of transmittal to the Senate, together with the proposal.

(The documents referred to are as follows:)

[House Document No. 192, Sixty-seventh Congress, second session.]

WAR DEPARTMENT,
Washington, February 21, 1922.

DEAR MR. SPEAKER: I forward herewith an offer, which I think worthy of consideration, made by the Alabama Power Co., proposing to complete the Wilson Dam at Muscle Shoals and to administer the Government's property at that point, which I think should be referred to the committee having jurisdiction over this subject. This offer is accompanied by a letter of explanation.

My comments on this offer are as follows:

1. The company will take out a license under the Federal water power act to complete the dam, locks, and power house, at its own expense, with initial installation of approximately 240,000 horsepower, subsequent installation to be made as required by the Federal water power act to meet market demands. This has the advantage of relieving the Government of all further expenditures in connection with completing these structures.

2. The company offers to furnish the Government, or anyone it may designate, with free power in the amount of 100,000 secondary horsepower for the

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production of fertilizer and munitions of war and research in connection therewith; and if for any reason this use of the power is discontinued the company will purchase same. This feature of the offer has the advantage of providing the Government a return on the $17,000,000 it now has invested in the water-power project.

3. The Government has an interest in the Warrior extension of the steam plant of the power company and certain other facilities and it owns the steam plant at nitrate plant No. 2, all of which the company offers to purchase for $5,000,000, less an amount to be agreed on to cover costs of locks and navigation structures at the Wilson Dam, which would be approximately two and a half millions of dollars, thus realizing a substantial sum on the Government's war-time investment in these steam plant facilities and at the same time placing them in the public service.

4. It is important here to note that the effect of this offer is to leave the Government in ownership of its two nitrate plants in the Muscle Shoals district, together with the Waco quarry, representing a war-time investment of some $75,000,000. They may be retained or they may be disposed of by lease, or otherwise, for the manufacture of nitrates, for munitions of war, or fertilizer.

5. The power company offers to operate and maintain the dam, power plant, and gates. There is a distinct advantage to the Government in this part of the offer. In the period of 50 years there may be occasion for substantial repairs and maintenance to the dam and gates as well as the power plant.

6. By the terms of this offer, the Wilson Dam property will be transferred to the licensee, who will complete the construction. The locks and navigation structures, when completed, are to be conveyed to the Government in fee. This feature of the offer has the advantage that it brings the entire property represented by the Wilson Dam project under local taxation laws.

7. The offer contains the further provision, based on section 16 of the Federal water power act, for taking over and operating the water-power project by the United States, whenever the safety of the United States demands, for the manufacture of nitrates, explosives, or munitions of war, or for any other purposes involving the safety of the United States. This broad provision of the act is of special importance to the United States in view of the location of the nitrate plants at this community.

8. It is proposed by the power company to develop this project under the Federal water power act which limits the license to a 50-year term. There is reserved, by section 14 of the act, the right to recapture by the Government at the end of that period, and if not so taken over by the Government, then the State and municipalities have preference over others. In this important respect the offer conforms to our national policy.

9. The company agrees to begin construction promptly and complete the same within a reasonable time. The construction must be begun and completed within the time prescribed in the license. If not begun, the license may be terminated upon order of the Water Power Commission; and if not completed, there is ample provision for protecting the rights of the Government in the situation. In addition, however, it is in the province of the Federal Power Commission to require such assurances and guaranties as may be necessary as to the financial ability of the licensee to complete its undertaking.

10. The Alabama Power Co. is a public utility. By the terms of the Federal water power act, its rates, service, and security issues are regulated by local authority, and if none exists, by the Federal Power Commission. These regulatory laws all provide for service to everyone without discrimination.

11. The Acting Judge Advocate General has expressed the opinion that the option claimed by the Air Nitrates Corporation under its contract is not a lawful option. If valid, it is an option on the plant as an entirety. It is believed that nothing in the option prevents substitutions in parts of the plant believed by the Government to be desirable. This offer substitutes power in amounts sufficient for the efficient operation of the plant for a plant to produce this power and no injury is done to the nitrate plant as a whole. Moreover, the Air Nitrates Corporation option arises only in case the United States determines to dispose of the plant as an entirety. Accordingly, even if the option is valid, it would seem not to interfere with the acceptance of this offer.

12. This offer makes no provision for Dam No. 3. To provide for the local requirements there is probably no necessity for the construction of this dam at this time, but in case the local demand and the requirements of navigation

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develop, there would be no difficulty in providing for the financing of Dam No. 3 on reasonably fair terms.

Yours very truly,

JOHN W. WEEKS,
Secretary of War.

The SPEAKER OF THE HOUSE OF REPRESENTATIVES.

ALABAMA POWER CO.,
Birmingham, Ala., February 15, 1922.

Hon. JOHN W. WEEKS,
Secretary of War, Washington, D. C.

SIR: This company offers to carry out the following plan by which the Wilson Dam at Muscle Shoals may be completed and the nitrate problem of the Government in connection therewith may be simplified without further advances or expenditures by the United States.

1. To take out a license under the Federal water power act under which we will complete the construction of the dam, locks, and power house at Muscle Shoals, known as Wilson Dam, or Dam No. 2, at our own expense, with initial installation of approximately 240,000 horsepower, subsequent installation to be made in accordance with the Federal water power act as may be necessary to meet the market demands.

2. To furnish free to the Government, or anyone it may designate, from the hydropower plant 100,000 horsepower as required for the production of fertilizers and munitions of war and for research in connection therewith; and if, due to changes in the art, this use of such 100,000 horsepower is discontinued by the Government, the Alabama Power Co. to purchase and pay for same in accordance with a schedule to be set forth in the license. This power to be the second 100,000 horsepower at any time available from the normal flow of the river.

3. To purchase the Government's interest in the Warrior extension of the steam plant of Alabama Power Co. and facilities, the Warrior and Sheffield substations, the transmission line from Warrior to Sheffield, and the steam plant at nitrate plant No. 2, together with the necessary rights of way, lands, and housing facilities, and to pay therefor in five equal installments the sum of $5,000,000, less an amount to be agreed on to cover the cost of locks and navigation structures at Wilson Dam, the first payment to be made when license is granted, the remaining payments to be made in four equal annual installments with interest at 5 per cent, with the right to anticipate any part or all of same.

4. To operate and maintain the power plant, dam, and gates, the Government to operate and maintain the locks for which the power company will supply the necessary power without expense to the Government.

5. The Government to transfer to the licensee the Wilson Dam property represented by its investment and commitments to date, free of liabilities and unencumbered, including the construction plant. The locks and navigation structures to be conveyed to the Government in fee on completion of construction.

6. Whenever the safety of the United States demands, the United States shall have the right, as more fully provided in the Federal water power act, to take over and operate the project covered by the license for the purpose of manufacturing nitrates, explosives, or munitions of war, or for any other purposes involving the safety of the United States for such length of time as may appear to the President necessary for such purposes.

7. The project covered by the license to be subject to recapture by the Government at the end of 50 years under the terms of the Federal water power act.

8. The licensee will agree to begin the construction promptly upon the enactment of the necessary legislation and granting of license and to complete the same within a reasonable time thereafter.

To facilitate the carrying out of this plan, we may find it necessary to organize a new company for the purpose, in which case, however, the obligations of this offer shall be binding upon this company in all respects as if it were the licensee.

Very respectfully,

ALABAMA POWER CO.,
By THOS. W. MARTIN, *President.*

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ALABAMA POWER CO.,
Birmingham, Ala., February 15, 1922.

Hon. JOHN W. WEEKS,
Secretary of War, Washington, D. C.

SIR: In accordance with the offer which we have to-day submitted to you with reference to completing the Wilson Dam at Muscle Shoals, we beg to make the following statement:

For many years the Alabama Power Co. has been serving electricity to the industries and the public in Alabama. It is an Alabama corporation, having several thousand stockholders in Alabama. It has now more than 17,000 customers and serves more than 50 municipalities. It has more than 1,500 miles of transmission lines, an installed electric generating capacity of 175,000 horsepower and is engaged in constructing a new hydroelectric plant on the Coosa River of 110,000 horsepower capacity under a 50-year license granted by the Federal Power Commission. Its facilities are now being used to supplement the power supply in Tennessee, Georgia, and South Carolina, and even as far away as North Carolina, 600 miles distant, and can be used in even more distant localities.

For many years this company has been identified with the Muscle Shoals situation. For several years before the war it had owned the site of the Wilson Dam, and at the outbreak of the war it was actually proceeding with plans for a power development at this point. These plans were made with the active cooperation of the engineers of the War Department, and their approval appears in House Document No. 20, Sixty-third Congress, second session, and House Document No. 1264, Sixty-fourth Congress, first session.

After this country entered the war the Government desired the site for war purposes. We thereupon donated the site to the Government and transferred to it for $1 titles and rights in connection with which we had already spent just under $500,000.

We still own dam site No. 5 and certain lands in connection therewith.

The Government being also then in need of power beyond our available capacity and time being of the first importance, we in like manner turned over to the Government, upon its request, the use of foundations and underwater structures then in reserve for our own use and enabled the Government to build thereon a 30,000-kilowatt extension to our Warrior River steam plant to be operated in conjunction therewith, and at the same time we placed a right of way owned by the company at the disposal of the Government for building a transmission line from Warrior to Muscle Shoals, a distance of some 90 miles. This enabled the Government to quickly secure the large amount of power required for constructing and operating the nitrate plants at Muscle Shoals. An agreement was signed between the Government and the company in November, 1918, binding the company to purchase this property from the Government after the termination of the war at a fair value.

When in April, 1921, the War Department inquired concerning the feasibility of completing the Muscle Shoals development, we expressed the opinion that the project was an economical and profitable undertaking, and promised that when the Government determined to complete it for commercial purposes the Government might reply upon the cooperation of this company. Recent discussions in Congress indicate that the Government is now prepared to devote this power to industrial uses, and it is, therefore, appropriate for this company now to offer its suggestions.

In formulating our plan we have sought to meet the requirements of the Government, first, in the desire to produce cheap fertilizers; second, to have nitrates available in time of war; third, to contribute to the industrial development of the region both by bringing in new industries and opening up navigation on the Tennessee River; and, finally, to complete the project without further expense to the Government.

Financial conditions have so far improved that we are now able to offer to complete the Wilson Dam and power project without cost to the Government, except for its locks.

We are assured by a number of important industrial enterprises that if the power from this development becomes available to the public they will establish new plants and factories in this locality. This, with the rapid growth of industries in the region which may be economically served—a territory larger than New England—is such that we are confident the entire power output will be promptly absorbed. If the Muscle Shoals power can be made available for every-

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body, we believe that not only will a number of new industries be established at and near Muscle Shoals, but the industrial development of Alabama, Tennessee, Georgia, North and South Carolina, and, indeed, of the entire South, will be promoted. Hence our willingness to assume the large responsibilities involved in our offer.

The Government has invested more than $70,000,000 in the two nitrate plants and the lime quarry, and it appears that one or both of these plants are essential for the production of nitrates for war purposes and useful for fertilizer production. Our proposal leaves the Government in full title and possession of these plants and the quarry, to give it 100,000 horsepower, and from two to five million dollars in cash for the operation thereof and for carrying on experiments in connection therewith. The Government will then be in position to turn over the two plants, with power and money for the operation thereof, to anyone capable of meeting the requirements of the Government and the farmers for nitrates and fertilizers, or the Government may retain the properties and itself carry on such experiments and manufactures as it sees fit. The Government can dispose of the plants in perpetuity for a long period of years or for a short period of years, and it should be able, with the free use of modern plants, no taxes, no power charges, and even with the free use of working capital, to attract the best skill and talent to be found.

The art of producing nitrates is still in its infancy and may so develop that in a few years these plants and this power will not be needed for producing either nitrates for war purposes or fertilizers. Our plan provides that in case the use of the 100,000 horsepower is discontinued by the Government, we will purchase that power from the Government and the proceeds will then be available for any use desired by the Government, including the amortization of its present investment in this situation.

We propose to take a license under the Federal water-power act. This act provides for a 50-year license with the right of the Government to recapture the property at the end of the license period. It requires the licensee to operate and maintain the power plant, dam, and gates at its own expense, to make all necessary renewals and replacements, and it permits the Government to operate and maintain the locks, power to be furnished free for this purpose by the licensee. Of special importance in this situation is the requirement that the licensee shall contribute to the cost of improvements in the headwaters of the river made either by the Government or by another licensee. This insures our cooperation in opening the upper reaches of the river to navigation and improvement.

This great project should be completed and at the earliest possible date coordinated with the power demands of the very extensive territory covering seven States within the reach of power from this source. The maximum value can be drawn from these Tennessee River possibilities only through their coordination with the power and reservoir opportunities on other rivers in Alabama and adjacent States now in process of progressive development in the different watersheds. Such is the conclusion in the report entitled "The power situation during the war," submitted to the Secretary of War in 1921, through the Chief of Engineers, from which we quote as follows:

"150. It therefore appears that a broad and well-founded judgment would dictate that the Muscle Shoals development should be interconnected for exchange of power with the existing power systems of the Southern States, and that this interconnection and exchange should be arranged for without delay, so that future construction, both at Muscle Shoals and elsewhere, can be directed for the production of plants which will supplement each other for economy of construction and operation."

Very respectfully,

ALABAMA POWER CO.,
By THOS. W. MARTIN, *President*.

Mr. MARTIN. Now, Mr. Chairman, do you wish me to explain in substance the merits of the proposal of the Alabama Power Co.?

The CHAIRMAN. I would not want to make any suggestion as to that, Mr. Martin. The committee, of course, will want to consider your proposition in connection with all the other propositions. Use your own judgment as to what you want to say and what explanation you think you ought to make.

Mr. MARTIN. Then, Mr. Chairman, I will briefly explain the offer.

The Alabama Power Co., being a public utility corporation, proposes to take out a license under the Federal water power act of June 10, 1920, under which it

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will complete the construction of the dam, lock, and power house at its own expense, with an initial installation of approximately 240,000 horsepower.

The terms of the Federal water-power act are that installations must be made to meet market demands from time to time in accordance with the directions of the Federal Power Commission. That obligation we would assume naturally as one of the conditions of our license.

We have proposed also to furnish the Government free, or to furnish free to anyone designated by the Government, from the hydroelectric plant when completed, 100,000 horsepower as required for the production of fertilizer and munitions of war, and for research in connection with those problems.

We also propose that if the use of this power is discontinued by the Government, due to changes in the art, the power company will purchase and pay for the power in accordance with such schedule as may be set forth in the license.

This power is to be the second 100,000 horsepower at any time available from the normal flow of the river.

Senator KENDRICK. Do you mind interruptions, or would you prefer to continue your statement?

Mr. MARTIN. No, sir. I will be very glad to have them.

Senator KENDRICK. I want to understand you. Now, this is not primary power, this 100,000 horsepower?

Mr. MARTIN. No, sir. We propose that the power company take the first 100,000 of primary power as the basis on which it can undertake this financial burden, and the second 100,000 of power to be available for use by the Government. Now, that power, Senator, is available, according to the charts which I will display to you presently, 84 per cent of the time. The full amount is available 84 per cent of the time, on the average. I will go further into the details of that later, unless you wish me now to go into it.

The CHAIRMAN. I was going to ask, since you say you prefer that we ask you questions as you proceed, do you propose to pay that in case the Government ceases to make fertilizer, due to the changes in the art, or for any other reason?

Mr. MARTIN. Yes, or for any other reason.

The CHAIRMAN. You say you will buy this 100,000 horsepower from the Government on the terms mentioned in the license?

Mr. MARTIN. Yes, sir.

The CHAIRMAN. How is that price going to be determined? What are you going to put in the license?

Mr. MARTIN. That I don't know. That is a matter for the Government; whatever may be determined by the Federal Power Commission to be a fair basis.

The CHAIRMAN. Then you propose, it seems to me, to pay for this 100,000 horsepower, or any part of it that the Government does not use, a price to be determined by the commission?

Mr. MARTIN. Or any board or individual or officer that may have authority to deal with it.

The CHAIRMAN. What board or officer does have authority to deal with it, or will have authority?

Mr. MARTIN. No one except the Federal Power Commission, under the present laws.

The CHAIRMAN. Yes; all right.

Mr. MARTIN. Now, we propose also to purchase the Government's interest in the Warrior extension of the steam plant of the Alabama Power Co. and facilities erected or constructed in behalf of the Government in connection with that plant; also the Warrior-Sheffield substations, the transmission line from the Warrior plant to Sheffield, and the steam plant at nitrate plant No. 2, together with necessary land and houses and facilities in and around the nitrate steam plant to make it an operating plant and to pay therefor in installments the sum of $5,000,000, less the amount to be agreed upon to cover cost of locks and navigation structures.

The CHAIRMAN. You mean you propose to pay $5,000,000 in the aggregate?

Mr. MARTIN. Yes, sir.

The CHAIRMAN. In installments?

Mr. MARTIN. Well, either in cash or in installments. We expressed it in our offer in five equal installments.

The CHAIRMAN. Your proposition is that you will give the Government $5,000,000 for the nitrate plants——

Mr. MARTIN. No, sir.

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The CHAIRMAN. For the steam plant, then, at the nitrate plants?
Mr. MARTIN. Yes, sir.
The CHAIRMAN. And the Government's interest in the Gorgas steam plant and the transmission line?
Mr. MARTIN. Yes, sir.
The CHAIRMAN. What else?
Mr. MARTIN. That is all.
Senator KENDRICK. Mr. Chairman, may I ask a question here?
The CHAIRMAN. Yes.
Senator KENDRICK. Are you through with your general statement?
Mr. MARTIN. I am not quite through with the discussion of the terms of the offer.
Senator LADD. If I understand you on one point, you said the $5,000,000 was less the cost of dams, locks, and so forth?
Mr. MARTIN. Less the amount, whatever may be agreed upon, to cover the cost of locks and navigation structures. The Secretary of War, in reporting to Congress, stated that that cost would be two and a half million dollars.
Senator LADD. Then you would be paying two and a half million dollars?
Mr. MARTIN. There would be an expenditure of $5,000,000.
Senator LADD. Less two and a half million.
Mr. MARTIN. Whatever it might be. We have assumed that the Government would undertake the construction of the locks, and our offer is to complete the Wilson Dam and the powerhouse.
Senator HEFLIN. You do not include Dam No. 3?
Mr. MARTIN. No, Senator; we have not included that; but so far as Dam No. 3 is concerned, I will make a statement about that presently.
Senator HEFLIN. Before you get away from that proposition about the Government selling this power, if it is not desired to use it for fertilizer purposes, suppose the Government should cease to want it for fertilizer purposes, but should desire to use it for some other purpose, what provision is made in your contract for that?
Mr. MARTIN. Well, we have not expressed this offer in terms of a contract, Senator. If the Government should need this power for some other purpose, I should think that would be a matter that could be expressed in terms of the license contract with the Federal Power Commission.
The CHAIRMAN. I suppose it would be immaterial to you whether the Government used it for fertilizer purposes or any other purpose?
Mr. MARTIN. Yes.
Senator KENDRICK. Suppose the Government would want to retain the steam plants and No. 2 dam to operate in conjunction with its 100,000 secondary power for manufacture of fertilizer or any other product, would that make any difference to you?
Mr. MARTIN. I would express it in this way, Senator:
The obligations which we assume here will approximate twenty-five to thirty million dollars in the course of the development of the project. Now, to assume those obligations we have offered to purchase the steam-plant equipment. There is a certain amount of primary power which we take. The Government takes secondary power. Then there is some remaining secondary power. This proposal of ours couples this whole situation together, and as we have worked it out we feel that the steam plant at Sheffield is necessary, in so far as it can supplement that secondary power.
Senator KENDRICK. Two things are certain about that steam-plant proposition: You could replace that with another one of your own, if you desired to do so. It is also certain that the Government, in order to receive any benefit from this secondary power, would have to subordinate that and support it, in fact, with a steam plant to give them power when they did not have sufficient power from the secondary power.
Mr. MARTIN. That is very true, Senator, unless you would set it up on the basis of witnesses who have, at different times, appeared before the committee to deal with this question of secondary power. They expressed definite views that the secondary power can be used in the manufacture of fertilizer. You might remember that this 100,000 secondary power, some of it, is available all the time. All of it is not available all the time. Some of it is available all the time, with the exception of brief periods—for about 4 years out of 30. That is, in those four years at certain periods of the year none of this power would be available. On the assumption, then, that some of this power is avail-

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able all of the time, and its use for fertilizer manufacture being seasonal, two of the witnesses who have appeared before committees here stated that the secondary power could be used commercially in the manufacture of fertilizer. In fact, that was the theory on which the matter was presented to the Congress a year ago—that the primary power should be sold to public utilities and the secondary power should be used in the manufacture of fertilizer. Major Burns testified before you last week that secondary power could be used to operate plant No. 2.

Senator KENDRICK. There are two things involved, of course, in the manufacture of fertilizer, just as in many other industrial enterprises. One of them is the matter of economy, and the next is the question of continued operation. Those are two vitally important things, because of the lost motion that occurs through the suspension of production or loss of your organization, discharging of your men, and all that sort of thing.

Mr. MARTIN. Well, it is a question to what extent that would apply.

Senator KENDRICK. Now, I am not going to take up your time, but I want you to make those points clear.

If the Government were going to operate that nitrate plant itself, which seems to be about the most sensible thing for it to do, and it should accept your offer of secondary power from the dam, it would immediately become necessary to reinforce that with steam power, and it is my judgment that this plant can not be improved upon. It looks to me like one of the best and most sensible pieces of construction that I saw in connection with the Muscle Shoals operation.

Senator MCKINLEY. Will you guarantee 100,000 of the secondary power for 10 months of the year?

Mr. MARTIN. Well, that would be available on the average, Senator. There would be some years when it would not be available.

Senator MCKINLEY. You appreciate the proposition that unless you could give them about 10 months' work you could not hold an organization together?

Mr. MARTIN. Yes.

Gentlemen, there will not be 10 months' power 30 years out of 30. There will be 10 months' power—we have plotted it, Senator, to show just exactly what the record has developed on that. If you wish me to go into that now I can do so.

Senator MCKINLEY. That is what I had in mind. Colonel Barden testified that with the auxiliary steam power there was always there 167,000 prime power, combining the steam and water power. Then, I am under the impression that he thought that there was 200,000 horsepower or more—perhaps 240,000 horsepower for 10 months by reinforcing it with the steam plant.

Mr. MARTIN. Oh, there would be, reinforced with the steam plant, unquestionably; but you asked me the question whether the run of the river would produce——

Senator MCKINLEY. No; I didn't. I asked you whether you would guarantee 100,000 horsepower for 10 months.

Mr. MARTIN. We would have to figure that out, Senator, to see just exactly what that would mean by way of any addition to our proposal.

Senator KENDRICK. The question, Mr. Martin, of the sale of that steam plant by the Government, if in its operations it would require this horsepower itself, would have to be contingent upon a guaranty of this power right along.

The CHAIRMAN. Perhaps not all the time, Senator. I can see a difference between operating a fertilizer plant and running a street railway or lighting a city, where you have to have the power all the time, every day in every year. For two months, on the average, in the year, you could run your plant with less power and you could still operate it to great advantage in making fertilizer, because the business would not be ruined if you should shut down a few days at a time occasionally. It would be better to run all the time, of course.

Senator KENDRICK. Senator McKinley said you would require a 10 months' guaranty.

The CHAIRMAN. I should think there ought to be somewhere in the neighborhood of 10 months, at least, if not 11, because your organization could not be held together on less time than that. If you gave everybody a holiday of 30 days a year, that would, perhaps, be about what would be allowed anyway. If you had it for 10 months, you would give everybody a holiday for two months in the year.

Senator MCKINLEY. As a business proposition, you should give the men at least 10 months' work in the year.

The CHAIRMAN. Yes.

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Mr. MARTIN. The greater part of this power at the cyanamide plant is used in the operation of the furnaces. When you come to that question, that could be discontinued and other operations taken up.

The CHAIRMAN. Major Burns has explained to us very clearly that we will be able to operate this plant when we have power and get ahead with one product of the plant and store it up so that when we did not have power enough to run it we could use the stored-up product that had been made. That product was carbide. In other words, the carbide that is necessary in getting nitrogen out of the air under the cyanamid process would exceed in quantity of manufacture the balance of the work, so that we could store up some in advance, and we could stop work on the carbide and go on and would not need the power for manufacture of carbide, but could use it for operation of the rest of the plant.

Mr. MARTIN. Of course in addition to that the steam plant is always going to be there, and it is always, in the working out of a problem of this kind, possible and practicable to develop some plan by which a certain amount of steam power could be available on some basis. That question is one that can be adjusted to meet a condition or the conditions on which you propose to conduct the operation.

Senator KENDRICK. I am sorry to interrupt you, Mr. Martin.

Mr. MARTIN. That is all right, Senator.

I would just like to mention this right here. When the question was up before one of the House committees last year the representatives of the Farm Bureau were testifying on this very question as to the feasibility of using secondary power to manufacture fertilizer at this plant, and it was fully gone into. They expressed the view that the secondary power could be used. Now, in the course of a discussion Mr. Magee, conducting the inquiry, asked these questions:

"Mr. MAGEE. Then if you are going to use the secondary power there would be certain seasons when you could not operate the plant?

"Mr. BOWER. Yes; at certain seasons.

"Mr. MAGEE. And you would have to shut down and throw out of work 2,000 or 2,500 men?

"Mr. BOWER. No; you would not shut down altogether and throw out 2,500 on account of the drop in horsepower, because your horsepower requirements at that plant are at the carbide furnaces."

That is the same problem that has been mentioned by the chairman here.

"Mr. MAGEE. You would have to cut down the number of your men?

"Mr. BOWER. Some of them, for a little while.

"Mr. MAGEE. What proportion would you cut down—50 per cent?

"Mr. BOWER. Oh, no, sir. It would simply be the men employed around the carbide furnaces, which would be closed temporarily only.

"Mr. MAGEE. You would have to disorganize your organization?

"Mr. BOWER. My thought would be this: You figure your total labor cost on cyanamide over the year, and you would run 10 months of the year and have a certain amount of labor cost, and then for two months suppose they were idle? It would pay to keep those men. It might add 50 to 75 cents a ton to your cost, but that would be so much cheaper——

"Mr. MAGEE. When you figure on using the secondary power, when you did not get that power, then you would not operate the plant?

"Mr. BOWER. Not the total plant; absolutely not."

Then he goes on to explain. I will hand to the secretary here the full conversation on this question before that committee. It might be of interest to you gentlemen to have it.

The CHAIRMAN. All right. Give it to the reporter, to be copied into the record at this point.

(The excerpts referred to are as follows:)

STATEMENTS OF MR. BOWER, OF THE AMERICAN FARM BUREAU, BEFORE SUBCOMMITTEE OF HOUSE COMMITTEE ON APPROPRIATIONS, FEBRUARY 15, 1921.

PRIMARY AND SECONDARY HORSEPOWER.

Mr. MAGEE. Unless you use the primary and secondary horsepowers for this same purpose how are you going to keep your men employed?

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Mr. BOWER. The power consumed in this plant is in the carbide furnace, using the secondary power, but the whole 100,000 secondary power is not used——

Mr. MAGEE (interposing). Unless you use the primary power you can not run the year round.

Mr. BOWER. That is the point.

Mr. MAGEE. Can you?

Mr. BOWER. No, sir; you can not run the total capacity of the plant.

Mr. MAGEE. Then you would have to use steam?

Mr. BOWER. Let me come down to that a little later. Then, the second statement of cumulative evidence——

The CHAIRMAN (interposing). You may proceed to make your statement. I realize that there have been interruptions, and we will try not to ask questions until you have finished.

Mr. BOWER. I do not object to questions at all.

The CHAIRMAN. I understand.

Mr. BOWER. That is the second thing that comes to our attention—the costs submitted by the War Department. Next, we have the report of the British ministry of munitions of war, nitrogen products committee, final report, issued after the war was over. I will not put in the record the names, but this was the character of the members of the committee [exhibiting]. I am referring to page 133 of the report, which says:

"In making the recommendations set out below the committee has been guided by the following salient facts, presumably developed by the previous study:

"(*d*) Of these salient facts, combined nitrogen (cyanamide or ammonium sulphate)—the two products proposed to be made at this plant—'can be obtained by synthetic processes at a cost at the factory which is less than half the market price of combined nitrogen from other sources, pre-war conditions being taken as the basis in each case.'

As to this cumulative evidence from the third source—the British committee—the War Department has been appealed from, but I never have seen any figures that contradict the cost. Mr. Washburn himself, when he found that he was not going to get this plant for his own purposes, repudiated the statement made before the Committee on Agriculture of the House in the Senate Committee on Agriculture; he practically denied it.

The CHAIRMAN. Permit me to interrupt you. The trouble about making a statement, where you are using all kinds of facts, and then waiting until you get through, is that what you have said has passed out of the minds of persons. I want to say that whether or not nitrogen can be manufactured in one country or another at a price that would permit its being used as fertilizer depends upon the cheapness of the power used.

Mr. BOWERS. Surely.

The CHAIRMAN. Take Norway, where the cost of power, as I recall, when you compute the investment in the plant, is a mere fraction of what it is going to cost at Muscle Shoals.

Mr. BOWER. It is very low—not so much lower.

The CHAIRMAN. When you bring in reports of that kind bearing upon power I can not myself bring my judgment to the conclusion that it is even cumulative—I do not believe that it has any bearing at all. You would first have to show me what a power plant that would produce 100,000 horsepower a year would cost, what the operation of it would cost, and then what you have read, it seems to me, would have some force.

Mr. BOWER. We have Colonel Cooper's estimate that the secondary power can sell for 1.2 mills.

The CHAIRMAN. I understand in Norway the cost to produce hydroelectric power is from $2 to $12 per kilowatt year, whereas at Muscle Shoals it costs $50 a kilowatt year. So the comparison you have given is one that it seems to me of itself falls of its own weight.

Mr. BOWER. Mr. Good, the cost of 1.2 mills per kilowatt hour, as figured by Colonel Cooper and submitted to your committee—I know it was submitted to the Senate committee at the hearing, and I presume that the same statement was made here—1.2 mills for the secondary power at Muscle Shoals figured on 100 per cent power factor, I think it is $7.58 a horsepower year.

Mr. MAGEE. I should like to get some idea of this if I can. Colonel Cooper gave us a very clear statement of his position. If I understand him rightly, and I do not wish to make any statement which does not agree with the statement

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he gave, his position is this: That he is in favor of completing this project solely as a light and power proposition.

Mr. BOWER. Yes, sir.

Mr. MAGEE. He figured that it could cost so much to complete this project that it could be completed in from three to five years, and that at the end of 10 years more the Government could lease this plant for a light and power proposition without even distributing the power, but selling it at the plant?

Mr. BOWER. Yes, sir.

Mr. MAGEE. And get a rental of two and a half million dollars a year, or 5 per cent net on the amount of money which he estimated it would cost to complete this project. I would like to know if you concur in that view, or whether it is your idea the Government should complete this project solely as a fertilizer proposition.

Mr. BOWER. No, sir; I do not claim so. Our thought is that with these possibilities, Mr. Magee, held out to us in the way of future production of fertilizer materials by the electric furnace——

Mr. MAGEE (interposing). Then if you do not concur with him, as I understand, the statement shows that there can be produced here about 88,000 primary horsepower. Is that right, Major Burns.

Major BURNS. In round numbers Colonel Cooper gave it as 100,000 primary horsepower. Do you propose in the fertilizer business to use this primary power?

Mr. BOWER. No, sir; we would be ridiculous to come in and take power for $28 or whatever that figures out, with power available at $7.48.

Mr. MAGEE. Then if you are going to use the secondary power there would be certain seasons when you could not operate the plant?

Mr. BOWER. Yes; at certain seasons.

Mr. MAGEE. And you would have to shut down and throw out of work 2,000 or 2,500 men?

Mr. BOWER. No; you would not shut down altogether and throw out 2,500 on account of the drop in horsepower, because your horsepower requirements at that plant are at the carbide furnaces.

Mr. MAGEE. You would have to cut down the number of your men?

Mr. BOWER. Some of them for a little while.

Mr. MAGEE. What proportion would you cut down—50 per cent?

Mr. BOWER. Oh, no, sir. It would simply be the men employed around the carbide furnaces, which would be closed temporarily only.

Mr. MAGEE. You would have to disorganize your organization?

Mr. BOWER. My thought would be this: You figure your total labor cost on cyanamid over the year, and you would run 10 months of the year and have a certain amount of labor cost, and then for 2 months they were idle. It would pay to keep those men. It might add 50 or 75 cents a ton to your cost, but that would be so much cheaper——

Mr. MAGEE. When you figure on using the secondary power, when you did not get that power, then you would not operate the plant?

Mr. BOWER. Not the total plant; absolutely not.

The CHAIRMAN. Why, Mr. Bower, I am amazed that the farm bureaus are interested in building this plant to sell 100,000 primary horsepower to a British corporation.

Mr. BOWER. Oh, no, sir.

The CHAIRMAN. That is practically what this means. I supposed that you were coming here and wanting to use the primary horsepower to manufacture fertilizer.

Mr. BOWER. If it does not cost too much. If it were not for that, we would, but it is uneconomical to do that.

The CHAIRMAN. Why, Colonel Cooper, who is one of the best engineers in the world, said that considering the erratic flow of the Tennessee River it would be uneconomical to manufacture fertilizer at this plant if you sold all of your 100,000 primary horsepower.

Mr. BOWER. And Colonel Cooper stated before the Senate committee——

The CHAIRMAN (interposing). On that matter you are putting your judgment as a representative of farmers against the judgment of one of the best hydroelectric engineers in the world.

Mr. BOWER. I am not criticizing his standpoint as a hydroelectric engineer, but I wish to put in the hearing Colonel Cooper's own statement.

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The CHAIRMAN. I can not understand why the farmers——

Mr. BOWER (interposing). Just a moment, Mr. Chairman. Colonel Cooper testified before the Senate committee: "I have put it on that basis. It is the basis I know something about. The fertilizer business I do not know anything about."

Mr. BYRNS. That is what he said here.

The CHAIRMAN. Colonel Cooper was here yesterday and testified positively that you would have to sell this primary horsepower at Muscle Shoals at the point of production, and that if you were going to use it for fertilizer you would have to use it at a basis of cost of 4.4 mills per kilowatt hour.

Mr. BOWER. He said himself before the Senate committee that he knows nothing about the fertilizer business.

COST OF SECONDARY POWER.

The CHAIRMAN. And that if you sold it for commercial purposes, as you have proposed, then you could not use the secondary power and keep 2,000 or 2,500 men there at work.

Mr. BOWER. Our thought has never been to use that big primary power unless it is cheap enough. We might agree with Colonel Cooper that that is too valuable for fertilizer production purposes.

Mr. BYRNS. Let me say that I think Colonel Cooper and General Taylor—and when the record is published it will be shown—made their statements in reply to hypothetical questions, assuming certain facts, put to them by the chairman, and both of them especially disclaimed any knowledge whatsoever of fertilizer or its manufacture.

The CHAIRMAN. I can see how representatives of these power companies down there would take this attitude, but why a representative of a farmers' organization should take this attitude is something I can not understand.

Mr. BOWER. Because we have got to get that cheap power to get our results.

The CHAIRMAN. But look at that power as shown by Plate No. 2. After you have taken 100,000 primary horsepower, as shown by the War Department's plates, which Colonel Cooper states are correct, then your power falls off so rapidly that for more than 40 per cent of the year you will have to run a steam plant, which you say you can not run and produce cheap power.

Mr. BOWER. Oh, not for 40 per cent of the year, Mr. Good.

The CHAIRMAN. Yes; for 40 per cent of the year after you take off your primary power.

Mr. BYRNS. Colonel Cooper did not agree with that statement, Mr. Chairman. He said that that statement was based on only a few years, whereas he had taken 22 years.

Mr. MAGEE. Colonel Cooper absolutely stated, Mr. Byrns, as I understand, that you could not run this plant as a fertilizer plant unless you used the primary horsepower.

Mr. BYRNS. Oh, no; I beg to differ with you. Colonel Cooper especially disclaimed any information about that, and any reply he made was in response to hypothetical questions put to him by the chairman.

Mr. MAGEE. Of course, his statement will show about that; but, as I understand, that was his absolute, unqualified statement.

Mr. BYRNS. He further said that he would work out and file with his statement the results of his investigations with reference to the flow of water covering a period of 22 years, and he especially disclaimed any knowledge of that plate to which the chairman has referred.

Mr. BOWER. I say that we want cheap power, the secondary power, for the fertilizer production. Along that line let me show you what the limitation is in this power. This is the testimony of Mr. Milton Whitney, Chief of the Bureau of Soils, before the Senate Agriculture Committee, with reference to the production of phosphate.

"The first thing we tried was the electric furnace."

This was with reference to the production of phosphoric acid by some new method instead of using sulphuric acid.

"We put in a mixture of phosphate rock, coke, and sand and fused it with electrodes and electric current. When this rock was in a molten condition dense white fumes of phosphoric acids were given off, and reaction taking place and silicate of lime being formed the phosphoric acid was set free. Those gases were put through a Cottrell precipitator and we obtained phosphoric acid in a very pure form. We entered into negotiations with a commercial firm in Hoboken and made a run of six months, and at the end of that time we found that the

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cost of the current was so great that the cost of producing phosphoric acid by this method was about three-fourths of a cent more than by the sulphuric-acid method. We felt, therefore, that unless we could get cheap water power the electric method could not be used. As a matter of fact, our calculations were based upon electric power at $25 per horsepower per year. If you could get electric power for $2 to $10 per horsepower per year you could use an electric furnace and get phosphoric acid out cheaper than you can by the sulphuric-acid method."

Now, of course, if you are going to take Colonel Cooper's position that you can not run this plant on anything except the selling price of primary power, then we have not got anything in this proposition, but we have never even thought about that.

Mr. MAGEE. It looks to me that you can not make flesh of one and fowl of the other. If the Government is going into this business, you have either got to make it an electric light and power proposition or you have got to make it a fertilizer proposition, and you can not get away from that conclusion.

The CHAIRMAN. Mr. Bower, in making your computation, what did you figure you would have to get the secondary power for?

Mr. BOWER. Well, I have here Mr. Whitney's statement. Of course I have not made any computation on this. I am not capable of doing that; but Mr. Whitney's computation was that if he could get electric power for $6 to $10 per horsepower per year "you could use an electric furnace and get phosphoric acid out cheaper than you can by the sulphuric-acid method."

Colonel Cooper's cost of the secondary power is 1 and 2 mills, which, I think, figures out $7.58 per horsepower per year.

Mr. MAGEE. His idea was, if you will read his statement, that you should sell all the power, not distribute it but sell it, the primary and secondary power for use in the localities.

Mr. BOWER. I would not be surprised if the Government adopted that method, that this secondary power possibly could bring a higher price for other purposes.

The CHAIRMAN. Colonel Cooper's figure, as I recall, was 1.3 mills per kilowatt-hour, or perhaps it as 1.2 mills. As I read the hearings here, the department has figured 0.75 mill.

Mr. BOWER. Yes.

The CHAIRMAN. So that if you had to have power at 0.75 mill, then the Government would be losing the difference between 0.75 mill and 1.2 mills, which Colonel Cooper says the secondary power could be sold for.

Mr. BOWER. And that would increase the cost of cyanamid, as I gave it, on page 95, referred to before, I think it would make it $23.04 instead of $21.97, by taking Colonel Cooper's cost of the secondary power. That is the difference between 0.75 mill and 1.2 mills.

The CHAIRMAN. Give that increase again.

Mr. BOWER. It is on page 95. I simply multiplied 2,808 kilowatt hours at fourths of a mill, which would figure out $2.10. At 1.2 mills it would be 2,808 kilowatt hours times 1.2. I made that computation, but unfortunately I did not keep it. That would increase the price——

The CHAIRMAN (interposing). About $1.25?

Mr. BOWER. It would be $3.37 instead of $2.10, an increase of $1.27 per ton. (Hearings on sundry civil appropriation bill for 1922, p. 119 et seq.)

Mr. MARTIN. I would also like to introduce at this point, since we have gone into this, the testimony which was given before the House Military Committee recently by Mr. Theodore Swann, president of the Federal Phosphorus Co., of Birmingham, when this same question was up. There is a company that has gone through its troublesome days, and its difficulties, and has developed a very interesting business at Anniston, Ala. It is now engaged in the manufacture of phosphoric acid by the electric-furnace process, and step by step the company plans to extend that development into fertilizer lines.

The CHAIRMAN. Are they making fertilizer now?

Mr. MARTIN. They are making simply phosphoric acid. They are experimenting now, and I think will shortly produce a fertilizer cotaining the three elements.

The CHAIRMAN. Do they have water power that they utilize?

Mr. MARTIN. Yes, sir. That company takes its power from our system.

The CHAIRMAN. It buys its power from you?

Mr. MARTIN. Yes, sir. It has taken a great deal of power over the past five years. The business was first developed as a plant to smelt manganese ore to

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meet war-time requirements, and when the war ceased the plant could not function because ferromanganese dropped, as you know, so quickly and sharply in price. Then Mr. Swann began to experiment with the phosphoric problem and afterwards produced phosphoric acid, and is now selling in the commercial market a high grade of phosphoric acid.

The CHAIRMAN. They are doing that as a commercial proposition and selling it on the market?

Mr. MARTIN. Yes, sir.

The CHAIRMAN. Is it a difficult process that they have?

Mr. MARTIN. It is quite a difficult process.

The CHAIRMAN. Does it require a great deal of power?

Mr. MARTIN. Yes, sir.

The CHAIRMAN. What did their power cost them?

Mr. MARTIN. They are using now primary power and primary power costs them between 6 and 8 mills.

The CHAIRMAN. Six mills per kilowatt-hour?

Mr. MARTIN. Yes, sir.

Senator HEFLIN. At what place do you supply this power?

Mr. MARTIN. We supply it from the Lock 12 power plant of the Coosa River, over lines which transmit that power to Anniston, a distance of 75 miles.

The CHAIRMAN. You develop that power from your dam on the Coosa?

Mr. MARTIN. Yes, sir.

The CHAIRMAN. And you transmit it over your transmission line 75 miles?

Mr. MARTIN. Yes, sir.

The CHAIRMAN. And sell it to them at approximately 6 mills?

Mr. MARTIN. Something over 6 mills.

Senator MCKINLEY. To get it down on a comparison with everything else, in horsepower that would be about 4½ mills per horsepower-hour?

Mr. MARTIN. Yes, sir. Let me say this. That product is produced and sells in the high-grade market, in the food-products market, and is in no sense a fertilizer, and cheaper power must be obtained if a fertilizer is to be manufactured which will compete with other commercial fertilizers.

The next step is to get that product to a point where it can sell in the fertilizer market, in which case Mr. Swann thinks it is necessary to take secondary power.

The CHAIRMAN. He will have to cheaper power in order to do that?

Mr. MARTIN. Cheaper power. He testified before the House Military Affairs Committee in this way:

"Having once been in the power business and knowing something of that end of the proposition, I always had in mind trying to find something that could utilize secondary power, knowing that it could be obtained cheap in the South, since the entire Appalachian section is one of seasonal stream flow. The fertilizer business is seasonal, so the two fit in together very well.

"This process is adaptable to be used anywhere where you can get secondary power or cheap power; and I say secondary because that means cheaper power than primary power, and, of course, should be used, if you want to get the greatest economy out of it, as near the center of consumption as you can."

His theory of the development is to establish plants at different locations where cheap secondary power can be had, at locations which are near the center of use of fertilizer.

Senator HEFLIN. What would the secondary power cost now if you should furnish that and transmit it to him at Anniston? The primary costs 4.5 mills per horsepower-hour.

Mr. MARTIN. I have not figured it on that basis.

Senator HEFLIN. If the primary power costs you 4½ mills, what could you supply secondary horsepower for?

Mr. MARTIN. We would not undertake to supply him with secondary power at Anniston, because it means transmission a distance of 75 miles, which would mean using only intermittently a large investment in lines. The feasible thing to do would be to locate that plant at the site of the power development, Lock 12, or at our new dam, and take power from a short transmission distance.

Going back to the terms of the proposal we submitted, we also propose to operate and maintain the power plant, dam, and gates; the Government will operate and maintain the locks, and the power company would supply the necessary power without expense to the Government.

Now, Mr. Chairman, the Secretary of War called especial attention to the question of operation of the power plant, dam, and gates, and referred to that

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as a distinct advantage to the Government, because assuming the duty of operating and maintaining the power plant, dam, and gates, of course, takes the burden off of the Government, and in case of trouble, leakage, or in case of any washout or any difficulties whatever of any kind, the burden passes to the licensee.

There is an offer pending which provides that there shall be paid to the Government a total fixed annual sum of $55,000 for repairs, maintenance, and operation of the dam, and gates and locks, rather than assuming the burden of whatever it might be, and we believe that this is one distinct advantage that the Government obtains under our proposal.

We also propose for the Government to transfer to the licensee the Wilson Dam property, represented by its investment and commitments to date, free of liabilities and unencumbered, including the construction plant. The locks and navigation structures to be conveyed to the Government in fee on completion of construction.

The Government has to-day approximately $17,000,000 of investment in the project. Whatever its investment is, at the end of 50 years, under the terms of the Federal water power act the Government may take over the project by paying the licensee simply the new money the licensee puts into the project. In other words, if the Government accepts the proposal of the Alabama Power Co., and the Alabama Power Co. as licensee in the 50-year interim, puts new money into the project, the Government would simply have to pay the licensee the net investment made by it, and in the 50-year interim, under the terms of our proposal, the Government receives a return on the $17,000,000 in the form of the charges which it may collect from us if we use the secondary power or in the form of a charge it may collect from somebody else if they manufacture fertilizer. In other words, the $17,000,000 is so set up under our proposal as to give a return to the Government during the 50 years, and if the policy of the Government at the end of 50 years is to take over the project under the terms of the water power act the Government only needs to pay us the net investment under the terms of the Federal water power act. We wanted particularly to bring that out at this hearing.

Senator KENDRICK. Then your proposition, Mr. Martin, is for 50 years only?

Mr. MARTIN. Yes, sir; for 50 years, under the terms of the Federal water power act, at the end of which time, as you know, under that act the Government may take over the project on paying simply the net investment. During the 50-year period, under the terms of the water power act, should the Government require the project may be taken over by payment to a licensee just compensation therefor.

Senator KENDRICK. And you furnish the money to complete the dam?

Mr. MARTIN. The dam, locks, and power house.

Senator KENDRICK. Do you propose to complete No. 3 Dam?

Mr. MARTIN. We have not proposed in this offer to complete No. 3.

Senator KENDRICK. Will that not be necessary, in carrying out the plan of the United States, in order to give navigation?

Senator HARRELD. Your plan does not contemplate the completion of No. 3 Dam?

The CHAIRMAN. No. You were not here when he made that statement, Senator.

Senator HARRELD. I think I got the idea just now from him that it did.

I would like to have you straighten that out.

Senator KENDRICK. You propose to finish No. 2, but you have not proposed to build No. 3, which is necessary to open up that river to navigation?

Mr. MARTIN. I will take up your point first, Senator Harreld. Then I will answer Senator Kendrick.

Senator HARRELD. Just state what you would do with regard to the dam.

Mr. MARTIN. Taking Dam No. 2, we would take up the work where the Government leaves it off. We propose to furnish all the money necessary to complete the Wilson Dam, to put in all necessary equipment, the Government's investment of $17,000,000, or whatever it has invested, to stand as it stands to-day, as the limit of the Government's investment. We propose to take it up there and complete it.

Senator HARRELD. You would proceed, now, under the terms of this Federal water power act?

Mr. MARTIN. Yes, sir; the Federal water power act of June 10, 1920.

Senator HARRELD. Just as though the $17,000,000 had not been spent?

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Mr. MARTIN. Yes, sir. We propose to take it up as it stands to-day. That act fits into this situation or answers one question which is very important—what becomes of the Government's $17,000,000. The Government puts no more money into it under the proposal that we make, but during the 50 years gets a return on its investment of that $17,000,000—namely, it gets 100,000 secondary power which it can sell to us or sell to somebody in the fertilizer business. At the end of 50 years, if it is the policy of the Government to operate the water powers, it may take the project over. It does not then pay us the $17,000,000, does not pay anyone the $17,000,000, but simply pays, under the terms of the Federal water power act, the net investment put into the project by the licensee from this day forward.

Senator HARRELD. That is Dam No. 2. What about Dam No. 3?

Mr. MARTIN. Our proposition does not deal with Dam No. 3.

Senator HEFLIN. The money you put in now to complete Dam No. 2, at the end of 50 years the Government would pay back?

Mr. MARTIN. On the basis of net investment; yes, sir.

The CHAIRMAN. In other words, under the Federal water power act at the end of 50 years if the Government wants to take the property it has got to pay to the licensee whatever it has cost to complete the dam. He is calling attention now to the fact that the Government already having spent $17,000,000, it would not have to, under their proposition, repay that. In other words, it would not pay the same amount to reclaim the property at the end of 50 years that it does ordinarily under the Federal water power act. It would only pay the company the amount that is necessary for them to expend to complete it from this point.

Senator HEFLIN. In other words, if it cost $17,000,000 to put in the dam as it now stands and the Alabama Power Co. should spend $17,000,000 more in completing it, at the end of 50 years the Government would have paid all of that $34,000,000?

The CHAIRMAN. No; just $17,000,000.

Senator HARRELD. The Government could take it by paying back the $17,000,000 to them?

Senator HEFLIN. Yes; $17,000,000. But the Government having paid the other $17,000,000 in the first place, would be out the whole $34,000,000 if it takes it over.

The CHAIRMAN. Yes; it would.

Senator HARRELD. But he proposes that that first $17,000,000 be repaid by the sale of this secondary power in the interim.

The CHAIRMAN. When the 50 years are up the Government has already spent the $17,000,000. It puts in that money. It would still have that interest in the plant—its investment of $17,000,000, which it would in fact own.

What are you going to do, Mr. Martin, about the Government's equipment if you take this over? The Government has a very large equipment that is necessary for anybody to have to complete this dam.

Mr. MARTIN. That is included in the $17,000,000, whatever that equipment is.

The CHAIRMAN. And you propose the Government shall turn that over to you?

Mr. MARTIN. And we will take it and complete the work.

The CHAIRMAN. What will happen to it when the work is completed? It will not be of much value, will it?

Mr. MARTIN. It will have some salvage value.

The CHAIRMAN. There is quite a mileage of railroad also.

Senator KENDRICK. It seems to me, Mr. Chairman, if I may interrupt, to be a consistent proposition on the ground that it will reduce the final payment of the Government because of this equipment being on hand.

Mr. MARTIN. Yes, sir.

Senator KENDRICK. The fact that the Government has the machinery now there undoubtedly will reduce the item of cost to the Government in the end.

Mr. MARTIN. Yes, sir; because we will have to provide that cost.

Let me suggest this difference, Senator Heflin, between the net investment and the terms which were used in the early discussions of the Federal water power act. The question of net investment is the actual net dollars which we may put into the project. It excludes the idea of going value, going concern. It excludes all intangibles. It excludes the added value which use and time may bring to a project of this kind, whereas if that were not the law, if the Government had the right to take it over at a fair value, of course that becomes, under the terms of the law, a question of what is the fair value at the end of 50 years under the then existing conditions, including going concern.

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Senator HARRELD. Good will and everything else.

Mr. MARTIN. The items of good will and going value are excluded by the terms of the Federal water power act. That becomes important in considering the amount that the Government would have to pay at the end of 50 years, and if by chance the net investment should be greater than the fair value the Government has a right to take it at fair value, then.

The CHAIRMAN. You mean if the net investment should be greater than the fair value the Government can take it at the fair value?

Mr. MARTIN. Yes, sir.

The CHAIRMAN. In other words, the Government, under the act, can take it at the fair value, which in no case shall exceed the net investment?

Mr. MARTIN. Yes. That is another way of expressing it, which, of course, preserves to the Government and to the public all of the increased or added values which accrue to this project in the course of 50 years.

As you understand, the act also provides that if the United States does not take over this project at the end of 50 years, then there is reserved to the State or to any municipality the preferential right to renew that license. We have no preference——

Senator KENDRICK (interposing). With the right to take over the dam?

Mr. MARTIN. Yes, sir; with the right to take over the project. If the State of Alabama wants to take over this project, the Government not wanting to take it over, the State could do it on the same terms as the United States.

Senator KENDRICK. It seems to me, unless the proposal includes the construction of Dam No. 3, there will be a long section of the river in which there is no navigation; and the thing would fail, so far as the navigation is concerned.

Mr. MARTIN. Yes, sir; Senator, that is very true.

Senator HARRELD. You make no provision in your offer for Dam No. 3?

Mr. MARTIN. We have not at this time, Senator. Dam No. 3, of course, is one of the projects which ought to be completed. The Dam No. 3 site is owned by the Alabama Power Co., and has been owned by it for a great many years. These two projects, Dams Nos. 2 and 3, have been the subject of consideration for 10 years, which I would like to go into before you gentlemen and show to what extent our company has gone into it.

When it comes to building Dam No. 3, it is not proposed to build that under possibly three years or four years, and we feel that power-market conditions will justify the building of that dam three to four years hence; and, so far as we are concerned, we would be in position to go forward with the building of that dam at the end or completion of Wilson Dam on some basis of cooperation with the Government.

Senator KENDRICK. It would seem to me, without having studied it very closely, that the nitrate plants and fertilizer plants would be almost contingent upon the opening up of that river to navigation for cheap transportation.

Senator HARRELD. Suppose the committee is of the opinion that it is all one project, including Dam No. 3, and it should all be embraced in the same contract, so that the Government can redeem it at the end of 50 years, including both Dam No. 2 and Dam No. 3, considering it all as one project?

Mr. MARTIN. It would be our purpose to undertake the building of Dam No. 3 under the Federal water power act.

Senator HARRELD. I can see this difficulty with that proposition: If we should accept your proposal, and if we made a contract with the power company at the end of four years to build the other dam, then at the end of 50 years, if the Government should want to take this project back, you would still have your rights in Dam No. 3?

Mr. MARTIN. We could not build Dam No. 3 under any law now except under the Federal water power act, which gives the Government the right to take it over at the end of 50 years.

Senator HARRELD. Yes; but the 50 years would be at an end at a different time.

Mr. MARTIN. There would probably be a difference of three years, but would that be a very serious matter? At any rate the terms of the Federal water power act control.

Senator KENDRICK. Mr. Chairman, do we have any information, do you recall, in regard to the cost of that steam plant at Dam No. 2, what it cost the Government?

The CHAIRMAN. Yes; we have figures on what that cost. It is all in the record. The steam plant, Senator, at the nitrate plant there, is between twelve and thirteen million.

Senator HEFLIN. Is that No. 2?

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The CHAIRMAN. Well, it is nitrate plant No. 2; yes—the cyanamid plant—the big one.

Senator HEFLIN. I understood Major Burns to say that the other one cost about $13,000,000.

The CHAIRMAN. No; we are speaking of the steam plant.

Senator HARRISON. Gorgas cost about $4,000,000.

The CHAIRMAN. Yes; the Gorgas plant.

Senator HEFLIN. I was speaking of No. 1 plant.

The CHAIRMAN. That cost about three or four million.

Major BURNS. One and a quarter million.

Mr. MARTIN. I would like to mention, in connection with this question of navigation on the Tennessee River, that even the building of Dam No. 3 does not necessarily complete this navigation, because, after you build No. 2, you have got to build, as explained to you by Colonel Barden, Dam No. 1.

Senator KENDRICK. Yes; but that is of incidental importance.

Mr. MARTIN. You have the Hobbs Island dam, the Buck Island dam, the Mink Creek dam, the Bellefonte dam, and the Widows Bar dam, mentioned by Colonel Barden when he testified before this committee. Those dams have to be built in ordr to complete navigation up to Hales Bar. (See H. Doc. 1262, 64th Cong., 1st sess., Pl. No. 2.) You have six dams in order to complete the scheme of navigation after you build No. 2 and No. 3. So that even the building of Dam No. 3 immediately does not open the river to navigation completely the year around, as Colonel Barden pointed out.

Senator KENDRICK. I am not quite clear on this point. I want to find out whether that river is open from Muscle Shoals in either direction.

The CHAIRMAN. No; but, Senator, from Muscle Shoals to the mouth of the river, if Dams Nos. 1 and 2 were completed, commencing way back, so far as the building of Dam No. 3, would dam up the river and would make the river navigable at 6 feet to the mouth of the river, with the exception of one place, where we would have to build what is known in this record as Dam No. 1, at the bridge across the river between Florence and Sheffield. The building of that dam would make the river navigable all the way to the mouth. These other dams that Mr. Martin speaks of are farther up the river and would add to navigation upstream.

Senator KENDRICK. After all, the downstream navigation is most important.

The CHAIRMAN. Yes.

Mr. MARTIN. Now, gentlemen, I will just add this conclusion on the details of the offer, that the financial obligations which the licensee would assume under the proposal we tendered involve very large sums, sums which approximate twenty-five to thirty million dollars, and the Alabama Power Co. is in position to undertake this financial obligation and has made arrangements as completely as is possible with the banking houses with which it has done business for many years, namely, Messrs. Harris, Forbes & Co., and Messrs. Coffin & Burr, and feels that it is in position to raise the necessary funds as this work progresses. This matter has been exhaustively examined by these banking houses and our own engineers, and we are satisfied we are in position to go forward and assume these obligations.

Senator KENDRICK. You would not be willing to take up this dam and complete it under the supervision of the Government in a way that would meet the requirements of Government supervision?

Mr. MARTIN. Yes, sir; the Government would approve the plans to be followed.

Senator KENDRICK. That would be the only way that I could see that you could complete it.

Mr. MARTIN. Of course, that is true, Senator, and that is the proposal we make.

Senator HARRELD. Does not the Federal Water Power Act provide all that?

Mr. MARTIN. Yes, sir; it provides for approval by the Secretray of War, the Chief of Engineers, and, in addition to that the plans must be approved formally by the Federal Water Power Commission.

The Alabama Power Co. is now constructing a dam in Alabama on the Coosa River under a 50-year license granted by the Federal Power Commission about a year ago, and this Coosa River is a navigable stream. This particular development will produce 120,000 horsepower.

Senator HEFLIN. That is Lock No. 18?

Mr. MARTIN. No, sir; that is just above Lock No. 18.

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Senator KENDRICK. Our Government engineers estimate the length of time to be three years required in the completion of this Dam No. 2. How much would you expect to shorten that period of time?

Mr. MARTIN. Well, we estimate the time approximately the same: 30 to 36 months. That is an approximation.

The CHAIRMAN. Now, Mr. Martin, you propose to take possession of the property there that the Government now has—all its utilities?

Mr. MARTIN. Yes, sir.

The CHAIRMAN. The houses where the men live, and all that?

Mr. MARTIN. On the Wilson Dam project.

The CHAIRMAN. Yes; on the Wilson Dam project. That is what I am speaking about.

Mr. MARTIN. Yes, sir.

The CHAIRMAN. Your proposition means that there shall be turned over to you not only the Government's railroad and bridges and its mixing plants and all that, but the houses at Wilson Dam where the men live?

Mr. MARTIN. Yes, sir; as part of the Wilson Dam camp.

The CHAIRMAN. Yes; that is part of the camp.

Mr. MARTIN. Representting part of the $17,000,000 that the Government has expended there.

The CHAIRMAN. Yes. That shall all be turned over to you, everything, indeed, except the locks, which the Government shall retain title to?

Mr. MARTIN. Yes, sir.

The CHAIRMAN. You will own all that property?

Mr. MARTIN. Yes; subject to the Government's option to take it over.

The CHAIRMAN. To take it over at the end of 50 years?

Mr. MARTIN. Yes, sir.

The CHAIRMAN. Do your engineers figure that you can take that property turned over to you in the condition in which it is now in and complete it for a less sum than the Government would complete it if the present force simply went on and finished it?

Mr. MARTIN. Senator, we do; because we do not have the 8-hour principle.

The CHAIRMAN. That is one of the questions that would arise right away.

Mr. MARTIN. We would eliminate overtime.

The CHAIRMAN. Before you go into those details tell me, if you can, how much less, in your judgment, it would cost your company to complete that work?

Mr. MARTIN. Well, I would not want to set an amount, Senator.

The CHAIRMAN. One of the reasons why you could do it for less is that you would work 10 hours instead of 8?

Mr. MARTIN. Yes, sir.

The CHAIRMAN. Or would you work more than that?

Mr. MARTIN. I do not think we would work over 10 hours; no, sir.

The CHAIRMAN. What other saving besides labor?

Mr. MARTIN. You would have certain holidays which the Government civil service provides for.

The CHAIRMAN. Let us see about the holidays. What holidays would the Government have to pay men for when they did not work, that you would get work out of?

Mr. MARTIN. All the legal holidays and half holidays during certain months.

Senator HARRELD. We have 13 in the course of the year in Washington.

Mr. MARTIN. Those holidays would come out.

The CHAIRMAN. What civil service rule do you refer to?

Mr. MARTIN. I am speaking generally. That is my impression.

The CHAIRMAN. You mean there is a civil-service rule applying to men who would go there and work on the dam, like, for instance, the fellow who shovels gravel or handles stone?

Mr. MARTIN. As to the question of his discharge, and so forth?

The CHAIRMAN. Yes.

Mr. MARTIN. I don't know that it is in that particular relation, but——

The CHAIRMAN (interposing). Do you mean to say that the Government officials could not discharge that kind of a man?

Mr. MARTIN. I do not want to go to that extent.

The CHAIRMAN. If they could not discharge him, would they have to give a civil-service examination before they put him to work carrying brick or shoveling sand?

Mr. MARTIN. I think I can find in just a moment a definite expression as to why you would have to keep them.

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In the former recommendation which was made for carrying out this project the Board of Engineers for Rivers and Harbors recommended that the development be made by our company, then proposing to undertake it, for the reason that the company would be relieved from certain Government restrictions and limitations. I have this report right here, and I will give you exactly the terms of the recommendation of the Government engineers at that time of this very project.

The CHAIRMAN. I am not particularly interested in what the report shows. I am trying to find out how much cheaper you can do this work than the Government.

Senator HARRELD. And why.

The CHAIRMAN. Then I want to get the items of saving, and I would like to have you go into detail on that. How are you going to save this money, in other words?

Mr. MARTIN. The questions I mentioned were thus presented by Major Burgess, district engineer, considering this project in 1916 (H. Doc. 1262, p. 38), his views being concurred in by Colonel (now General) Beach: "The contractor does not have to stop work for so many holidays, as would be necessary for the Government force. The contractor is not usually permitted to work either on Sundays or on legal holidays, but he is not required to suspend work on the Saturday half holidays, which, by Executive order, are observed by the Government force."

The importance of this latter fact may be noted from the table in paragraph 68, where the item to cover Saturday half holidays is estimated at $360,000. The contractor has another advantage in his freedom in the selection of his employees, which enables him to demand the greatest degree of efficiency. In the Government service employees are selected from registers of eligibles established by the Civil Service Commission. Whenever eligibles are certified by the commission the men usually are efficient, although the efficiency has been proved more by theoretical examination than by the test of experience. Frequently, however, the commission is unable to certify a list of names and, in fact, in this engineer district it has been the exception rather than the rule to have eligibles available when they are needed.

"The result is that noncivil service or temporary men must be employed. This would be entirely satisfactory if such temporary employees, when found efficient, could be retained; but under the regulations of the commission such temporary employees are subject to discharge when subsequent examinations have resulted in the establishment of a register. Such unnecessary changes of employees during the progress of the work, and the forced discharge of men whose efficiency has been proved by actual service rather than by theoretical examinations, necessarily reduce the average efficiency of Government employees on Engineer Department work. The contractor, knowing that his profit depends on the quality and efficiency of the men engaged by him, hires only this kind, or discharges men who do not meet his standard. However desirable it seems to the Government engineer in charge of work of this character to secure the highest degree of efficiency in his force, he has very little power to obtain it.

"78. The conditions mentioned above indicate the advisability of contracting Government work in the Engineer Department whenever practicable."

The CHAIRMAN. You don't mean, Mr. Martin, that the Government Civil Service has to examine all those fellows that work on this plant down there, do you?

Mr. MARTIN. I am quoting from House Document 1262, page 36, presented by the Board of Engineers for Rivers and Harbors as their reason why this work should be undertaken by a private company rather than by the Government.

As to the exact effect of the civil service upon this work I can only stand upon what these gentlemen said in this report.

The CHAIRMAN. I see. You have no knowledge of your own with regard to that?

Mr. MARTIN. No. It has been in my mind for many years that that was applicable. It arose from this report that is before the committee and is signed by Major Burgess, concurred in by General Beach, who was at that time a colonel in the Corps of Engineers.

In our estimate of cost of construction we have had to provide transmission lines, and our figure of twenty-five to thirty million dollars capital required embraces not only the cost of this work, but bringing the power to market.

Senator HEFLIN. Mr. Chairman, Mr. Ford claims, as I understand it, that he can complete this dam for twenty to twenty-two million dollars. The Gov-

ernment's estimate of cost is about $28,000,000. So there would be a saving of six or eight million dollars in Mr. Ford's suggestion. You do not know how much cheaper, then, you could build it than the Government, Mr. Martin?

Mr. MARTIN. Well, we have made various estimates on the work to be done, Senator.

The CHAIRMAN. We would like to have that. I wish you would put those figures in the record. I don't suppose your contract binds you to do it for less; yet we would like to have the opinion of the men making the various offers, because I think that has a great deal to do with the action of the committee in deciding what action it should take.

Mr. MARTIN. Yes. We will get up some figures and present them to you to-morrow.

The CHAIRMAN. All right.

Senator KENDRICK. Any contract considered by the Government must necessarily include No. 2 for the Government to know what the discrepancy is in the actual cost.

Mr. MARTIN. Senator, the Federal Power Commission has established accounting rules, and they know exactly what money goes into the project. In addition to that, the Government now, at our work at the Coosa River, maintains two inspectors constantly at our work.

Senator HARRELD. That is covered by the Federal power act.

Mr. MARTIN. By the Federal power act.

The CHAIRMAN. If you have reached a place in your testimony where it would not disturb you, I would like to make some inquiry about Gorgas, where the Government and your company own in partnership, as it were, a whole lot of property.

Mr. MARTIN. I would be glad to have you ask those questions of Mr. Dent. He was going to take that up.

The CHAIRMAN. If somebody else was going to do it, I don't want to interfere with your plan.

Senator HEFLIN. I suggested to you that Mr. Dent would be heard on the Gorgas proposition.

The CHAIRMAN. I understood that Mr. Dent was to be heard on the legal phases of it. There are some legal questions involved. I thought you would be able to tell us just exactly how the Gorgas plant is divided up.

Mr. MARTIN. I am at your service, Senator.

The CHAIRMAN. How is it owned? Is there anything else you want to say?

Mr. MARTIN. There are some general statements which I might hurry through to this extent, Senator.

The Alabama Power Co. is a corporation organized under the laws of Alabama in 1906. The Muscle Shoals Hydroelectric Power Co. is another corporation organized in that State about the same time. Those companies were owned by individuals in that State, and those companies acquired certain power sites, and there was also another company known as the Birmingham, Montgomery & Gulf Power Co. that acquired a site on still a third river. Those joined with other citizens of our State, and in 1912 they succeeded in interesting a group of people to undertake their power development. Mr. James Mitchell was the man who came into it in 1912 and assumed the obligation to raise funds for power development. Mr. Worthington was the gentleman who was in charge of Muscle Shoals, with his associates. They conceived a plan of developing Muscle Shoals upon the theory which you brought out in your hearings, namely, the building of the two dams at Muscle Shoals, together with storage reservoirs in another watershed, and then they became interested in Cherokee Bluffs, a power site on the Tallapoosa River, and another one on the Little River, in Alabama, with a view to building storage reservoirs and tying these developments together by transmission lines and thus supplementing the Muscle Shoals project.

This scheme of development of Muscle Shoals was made the subject of a proposal by the Muscle Shoals Hydroelectric Power Co. in 1913; and, later, in 1916, excerpts of which I will hand you, they involved a plan of building these reservoirs and sites and bringing to the aid of the Muscle Shoals stored water something in excess of 50,000,000,000 cubic feet, which would have the effect, as shown by the official documents in which these matters are so fully considered, of practically doubling the primary power at Muscle Shoals and making secondary power at Muscle Shoals valuable which otherwise would not be valuable. Now, that plan of development was recommended on two different occasions to the Congress by the engineers of the United States, and I

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wish to call attention to those reports: Rivers and Harbors Committee, Document No. 20, Sixty-third Congress, second session, of the date of May 18, 1914; also House Document No. 1262, Sixty-fourth Congress, first session, dated June 28, 1916.

That plan was one of cooperation between the Government and the company, then known as the Muscle Shoals Hydroelectric Co., which was owned by our company at that time.

The CHAIRMAN. That is a subsidiary of the Alabama Power Co.?

Mr. MARTIN. Yes, sir.

The CHAIRMAN. And those other companies you have named are subsidiaries of the Alabama Power Co.?

Mr. MARTIN. Yes, sir.

The CHAIRMAN. How many other companies does the Alabama Power Co. own? How many subsidiaries have you?

Mr. MARTIN. Four or five.

The CHAIRMAN. What do you have them for? Why don't you own the property directly?

Mr. MARTIN. We do own all the developed properties.

The CHAIRMAN. When it is developed it is transferred to you?

Mr. MARTIN. Yes, sir.

The CHAIRMAN. What is the object of that?

Mr. MARTIN. We did not organize them. We had no object in organizing them. We just took them over.

The CHAIRMAN. How did you become the owner of them?

Mr. MARTIN. We purchased the stock from the various people in Alabama who organized them. There were three different groups of citizens of our State, who had no relation with each other, who conceived the idea of development at one place, then at another, then at another. They went out and made country-wide, even world-wide efforts to find somebody to develop these water powers. They all got together in 1912 and transferred their stock holdings to Mr. James Mitchell and his associates, who had not prior to that time been interested in the projects in any way.

The CHAIRMAN. And formed the Alabama Power Co.?

Mr. MARTIN. They turned these properties over to the Alabama Power Co., along with the other companies, and the Alabama Power Co. became the operating company.

The CHAIRMAN. So often I can not understand—sometimes I can—why a corporation should maintain so many subsidiary corporations, making a complex network of corporations owning each other.

Mr. MARTIN. It is the policy of our company to operate only in the name of the Alabama Power Co. That is the soundest and best way to operate.

Senator HEFLIN. Do you mean that these other organizations were perfected by people outside of the Alabama Power Co., and that you then bought their stock?

Mr. MARTIN. For instance, Captain Lay organized the Alabama Power Co. We purchased the stock of that company. Mr. Worthington and his associates organized the Muscle Shoals Co. They also organized the Birmingham, Montgomery & Gulf Co. The same groups were not interested in all of those companies. Those people all got together in 1912 and sold their interests in those various companies to Mr. Mitchell—as I have stated.

The CHAIRMAN. And he gave them for it stock in the Alabama Power Co.?

Mr. MARTIN. And money and bonds and assumed the duty of development.

We began development of Lock No. 12 on the Coosa River. That development has been completed. It was made under act of Congress of 1907. It has 110,000 horsepower capacity. Since 1912 no company in our State has been in position to develop water power because, up to 1920, there was no Federal legislation. We tried in 1912 to get Lock 18 built, and one other development in our State, and it happened that the United States Government owned 80 acres of land, 5 acres of which were flooded, and the Secretary of the Interior withdrew the land from entry 10 years ago. We were, off and on, 12 years getting the right to use that 5 acres of land.

Senator HEFLIN. What has your company done at Lock 18?

Mr. MARTIN. It has done nothing, because, as you recall, President Taft vetoed the bill you introduced anthorizing that development, and in his veto message of August 24, 1912, said: "I deem it highly important that the Nation should adopt a consistent and harmonious policy of treatment of these water-power projects which will preserve for this purpose their value

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to the Government, whose right it is to grant the permit. The necessity for the adoption of such a policy has recently been pointed out, with my approval, by the Secretary of War, and I see no reason why this bill should be exempted from the safeguards which have been recommended by him in the cases of other bills now pending before Congress."

Senator HEFLIN. At Lock 12 you have got a dam?

Mr. MARTIN. That is developed.

The CHAIRMAN. You were mentioning these reservoir sites. To my mind that is extremely important in connection with the development of power on the Tennessee River, but you haven't anything of that kind in your proposal?

Mr. MARTIN. That is, to develop these reservoirs?

The CHAIRMAN. Yes.

Mr. MARTIN. It is not expressed in our proposal, but that is exactly our plan, Senator.

The CHAIRMAN. Why is it not in your proposal?

Mr. MARTIN. I don't know that we considered it essential. We would be very glad to make any obligation necessary about it.

The CHAIRMAN. How much investigation have you made? Have you made surveys to see what can be done; have you anything definite on it?

Mr. MARTIN. Yes, sir.

The CHAIRMAN. It is about time to quit now, but I would like to have you go into that to-morrow very fully.

Mr. MARTIN. We have a great deal of detail about that, Senator.

Senator KENDRICK. I would like to ask a question: First, I understand Mr. Martin to say that his proposition includes the purchase of the Government's interest in the Gorgas plant, in the transmission line between that and Muscle Shoals, and the steam plant at Muscle Shoals, and the incidental property that the Government has and used in the construction of the dams, of $5,000,000?

Mr. MARTIN. Plus the 100,000 horsepower.

Senator KENDRICK. Yes; I understand that. Now, then, the question a moment ago as to the cost of the steam plant developed the fact that between twelve and thirteen million dollars had been expended. What did the Government investment amount to at the Gorgas steam plant?

Mr. MARTIN. About three and a half million dollars. Then there was an additional investment in transmission line subsequently. The total was approximately $5,000,000.

Senator HEFLIN. And what was the expenditure of the Alabama Power Co.?

Mr. MARTIN. Why, Senator, we have invested there something in excess of $4,000,000 in steam plant and various other lines leading from that. In addition to that we have investment in coal mines.

Senator HEFLIN. I am speaking of the plant proper. You invested nearly as much or about as much as the Government?

Mr. MARTIN. About as much.

Senator KENDRICK. That is a little aside. I wanted to get the actual investment of the Government, which amounts, according to your statement, to about $18,000,000?

Mr. MARTIN. Yes, sir.

Senator KENDRICK. For which you offer $5,000,000?

Mr. MARTIN. Plus the power. Of course the power has its value, and the further development has its value.

Senator HARRELD. Now, speaking about these storage reservoirs, you are going to store not alone waters of the watershed that belongs to the Tennessee River, but you your plans include the storage of waters of other watersheds, too, didn't you say, that might be diverted and used at Muscle Shoals?

Mr. MARTIN. Yes, sir. Our plan involves not storage on the Tennessee River but at different watersheds in Alabama.

The CHAIRMAN. Well, tributaries of the Tennessee?

Mr. MARTIN. No, sir.

The CHAIRMAN. Then you haven't any storage proposition that will increase the flow of the Tennessee?

Mr. MARTIN. Not to increase the flow, but it will increase the power by bringing to Muscle Shoals power from the watersheds of other rivers.

The CHAIRMAN. Then you will have to construct canals?

Mr. MARTIN. No; transmission lines.

The CHAIRMAN. Oh, power plants. I did not understand that.

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Mr. MARTIN. That was the theory on which the proposed development proceeded in 1913 and 1916, and which was recommended to Congress.

The CHAIRMAN. Well, then, you have not made any investigation or survey with a view to storing water in reservoirs either on the Tennessee or any of its tributaries above Muscle Shoals?

Mr. MARTIN. No, sir. We have no interest and have not made that investigation.

The CHAIRMAN. You realize that is a very important thing in connection with the amount of primary power at those two dams?

Mr. MARTIN. Yes, sir; but we think it is much more feasible to store that water on another watershed and build transmission lines and thus supplement the waterpower than by developing these dams a distance of some several hundred miles away.

The CHAIRMAN. Then you would not increase the primary power at the dam?

Mr. MARTIN. We would increase the value of the secondary power.

The CHAIRMAN. Oh, yes; you could do that by getting your power anywhere; but, of course, if you could store water, if there is a practical place where the water can be stored at an expense that is reasonable, that of itself would increase the primary power, which adds, of course, very greatly to the value of it.

Mr. MARTIN. That is the scheme of development which we have long projected in connection with Muscle Shoals.

The CHAIRMAN. You have made no survey with regard to that?

Mr. MARTIN. Not on the Tennessee River.

The CHAIRMAN. You can not increase the flow of the water or you can not store up the water that is going to flow over Muscle Shoals by building a dam on some other watershed?

Mr. MARTIN. No; but we could increase the power.

The CHAIRMAN. Yes; you could do that and you could do it by building a steam plant and carrying the power on a transmission line.

Senator HARRELD. In other words, you would transmit power rather than transmit water?

Mr. MARTIN. That is correct, Senator.

The CHAIRMAN. But the weakness of the Tennessee River as a power proposition, one of its greatest, if not its greatest weakness, is the vast difference between the minimum and maximum flow of the river, which means that the secondary power is very great and, comparatively speaking, the primary power is small.

Mr. MARTIN. Absolutely, Senator. That is its weakness

The CHAIRMAN. Yes. I have said that I have thought it was the greatest weakness there was.

Mr. MARTIN. This plate shows the available energy at Muscle Shoals, Tallapoose River System, and Little River, and you see the primary power runs to 2,453,000,000 horsepower hours per year. You see that is from your secondary available power. When you look at the other chart, plate 109, where Muscle Shoals stands alone, you simply have 700,800,000 horsepower hours per year, and that is your limit.

The CHAIRMAN. Your plan of conducting power over there does increase the power, of course, that you can utilize, but it does not increase the primary power of the Tennessee River.

Mr. MARTIN. Well, no.

The CHAIRMAN. You have your secondary power all going to waste there, just the same. It is simply supplemented with some other power.

Senator HARRELD. In other words, you propose not only to have reserve from your steam plant, but reserve from other water power from other watersheds?

Mr. MARTIN. That is correct, Senator.

The CHAIRMAN. You are just developing more power, that is all?

Mr. MARTIN. Developing another watershed. So you would be on the Tennessee. You would develop additional water power on the Tennessee.

The CHAIRMAN. Probably. And if you could get power out of it, so much the better, but if you could not, you simply equalize the flow of the Tennessee River over the dam and you would have less water going over at the time it was going to waste, but more water when you could use it to develop power.

We will have to adjourn now until 10.30 to-morrow morning.

(Whereupon at 12 o'clock, noon, the hearing was adjourned to 10.30 o'clock a. m. Tuesday, April 18, 1922.)

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MUSCLE SHOALS.

TUESDAY, APRIL 18, 1922.

UNITED STATES SENATE,
COMMITTEE ON AGRICULTURE AND FORESTRY,
Washington, D. C.

The committee met, pursuant to adjournment, at 10.30 o'clock a. m., in Room 224, Senate Office Building, Senator George W. Norris presiding.

Present: Senators Norris (chairman), Ladd, Kendrick, and Heflin.

The CHAIRMAN. The committee will come to order.

STATEMENT OF MR. THOMAS H. MARTIN—Resumed.

Mr. MARTIN. I will try to relate, Mr. Chairman, a consecutive story in a few minutes, growing out of the various investigations and reports which have to do with the improvement of the Tennessee River.

The CHAIRMAN. All right.

Mr. MARTIN. The rivers and harbors act of March 3, 1909, contained a provision for—

"Survey of Tennessee River from the confluence of the Holston and the French Broad Rivers to its mouth, with a view to securing the best permanent navigation by open-channel work or locks and dams, or both, and making an estimate of the cost of same, with a view to securing a depth from Knoxville to Chattanooga of 6 feet, if obtainable, or any such less depth as may be practicable between such depths and the present project depths; and from Chattanooga to the mouth of the river a depth of 9 feet, if obtainable, or such less depth as may be practicable between such depth and the present project depth."

This provision of the rivers and harbors act of 1909 was the basis for a survey of the upper reaches of the Tennessee River, and the result of this survey was transmitted by letter of the Secretary of War, of date December 29, 1911, to the Speaker of the House of Representatives, and is printed as a House Document, No. 360, Sixty-second Congress, second session, and is a very important document in connection with this whole subject.

The subject was considered by the district officer, Maj. William W. Harts, Corps of Engineers, by the division engineer, Lieut. Col. J. V. Warren, Corps of Engineers, and by the Board of Engineers for Rivers and Harbors, and transmitted with the indorsement of the Chief of Engineers to the Secretary of War under date of December 28, 1911. The report is the result of an exhaustive survey of the Tennessee River for a distance of 446 miles, from the confluence of the Holston and French Broad Rivers, 4½ miles northeast of Knoxville, to Riverton, 30 miles below Florence, Ala.

The report recommended the improvement of this stretch of the Tennessee River for navigation purposes by providing 3-foot navigation from Knoxville to Chattanooga; 6-foot navigation from Chattanooga to Riverton, with the exception of 37 miles of the Muscle Shoals stretch, and 6-foot open-channel navigation from Riverton to the mouth of the Tennessee.

The engineers made a most complete and detailed survey and submitted with the report an immense amount of data and information regarding the stream flow of the Tennessee, the water fall, the profile of the river illustrated by a number of maps, diagrams, and charts.

Among other things, study and investigation was made of the possibility of improvement of navigation and waterpower development by means of reservoirs and forestry. On page 40, under the subject of "Improvement by reservoirs and Forestry," the engineer reports as follows:

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"IMPROVEMENT BY RESERVOIRS AND FORESTRY.

"It has often been stated of late that the improvement of streams may be effected most economically by means of immense artificial reservoirs in the headwaters, of such capacity that the greater portion of the winter's floods may be retained for a ttime; the water thus impounded to be released little by little during low stages so as to maintain greater depths in the streams below.

"This plan in theory combines several related benefits, including among others the reduction of flood heights, land reclamation, the creation of valuable water powers, and the clarification of the flow. Although plausible at first appearance, it presents many difficulties in application. One plan, seriously suggested, even proposed the construction of reservoirs in the headwaters of the Tennesee River capable of impounding over 715,000,000,000 cubic feet. This involved the erection of many high dams, one in the lower French Broad River having a height of upwards of 200 feet and a capacity of nearly 200,000,000,000 cubic feet, or more than four hundred times the capacity of the Johnstown Dam, the destruction of which caused such a disaster a number of years ago. It seems needless to point out that the great expense of such works and the time required before any useful results could be looked for in the stream below would sooner or later condemn this method.

"Furthermore, it is admitted that the benefits to navigation claimed to be obtainable by this method on the Ohio could never be fully achieved there without extensive contraction works and other costly adjuncts in the lower river. Similar works would also likely be necessary in the Tennessee River, the cost of which alone might easily amount to more than that of the improvement as now recommended.

"The successful operation and coordination of a system of widely scattered dams would present insuperable difficulties. The length of time required for the flow to reach the lower river from the reservoirs, certainly several weeks in the summer time, would render it necessary to operate them by guess work or on the averages of previous years, manifestly very unsatisfactory methods.

"In addition to these considerations, the insecurity of the dams themselves, the danger to life and property in case of a breach, the impairment of property values due to this risk, the uncertainty of beneficial results, and the likelihood that the reservoirs would sooner or later become filled with sediment, all combine to lead to the belief that, in addition to involving great and needless expense, this method is a most precarious one, and of doubtful utility.

"That it would incidentally develop water power of considerable value seems undeniable; but whether the needs of navigation and those of power production would always correspond is open to serious question. That the reservoirs might be so controlled as to reduce floods somewhat is conceded; but the combination of several widely differing utilities under a single management is not always best for those who bear the expense of the original undertaking.

"On the upper Mississippi, in Minnesota, there was established by the United States in the seventies a reservoir system which is the greatest in the world in capacity, the aggregate storage amounting to upward of 93,000,000,000 cubic feet. The benefit to navigation resulting from this system is so slight as to render the maintenance of the works a matter of questionable economy; but the power development rendered possible thereby—for private use—has always been an active argument for continuing the system in operation. It is safe to say that if navigation interests alone were to be considered no engineer to-day thinks of recommending such a system, notwithstanding the unusual advantages offered by the physiography of the region embraced by the Mississippi headwaters.

"A board of engineers in 1873, when investigating plans for the improvement of the Ohio, examined this reservoir method with great care and abandoned it as unlikely to yield certain and efficient results. In 1887 another board of engineers after a study of the reservoirs on the headwaters of the Mississippi refused to recommend the extension of the system for the improvement of the Wisconsin, Chippewa, and St. Croix Rivers; and in 1909 the method was rejected for the improvement of the Mississippi.

"As an accessory it may have some value, but owing to its great cost, the uncertainty of obtaining satisfactory results, the danger to life and property, the length of time necessary for the installation of the works, and the difficulty of operating them even after completion, this method as an exclusive means has been generally abandoned and is believed to be unworthy of consideration

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for the improvement of the Tennessee River. It may be broadly stated that no hope of reducing the cost of improvement in this way can be entertained."

Col. William T. Rossell, Corps of Engineers, and senior member of the Board of Engineers for Rivers and Harbors, concurred in the statements of the district engineer in the following language (p. 170 of the report):

"In compliance with law the board reports that there are no questions of terminal facilities, water power, or other subjects so related to the project proposed by it that they may be coordinated therewith to lessen the cost and compensate the Government for the expenditures involved."

The result was that the reservoir plan was definitely abandoned, as no relief or assistance of any kind was apparent from its installation. The district engineer, the division engineer, the Chief of Engineers, and the Board of Engineers for Rivers and Harbors all concurred in the recommendation that no project be submitted for the improvement of the Muscle Shoals stretch of the river in view of a resolution by the Rivers and Harbors Committee of the House directing the Board of Engineers for Rivers and Harbors "to submit as soon as practicable a revised report and estimate of the cost of construction of the necessary locks and dams for the improvement of said river and the development of water power in connection therewith as proposed by the Muscle Shoals Hydro-Electric Power Co., together with a detailed plan of cooperation between said company and the United States, such report and plan to state the equitable amount that the Government of the United States ought to contribute to such work."

The investigation and survey pursuant to the last-mentioned authority was in progress and was transmitted to Congress by the Chief of Engineers on May 18, 1914, being entitled House Committee Document 20, Sixty-third Congress, second session.

The CHAIRMAN. Is that all they say about it?

Mr. MARTIN. No. There is a very elaborate report.

The CHAIRMAN. When was that report made?

Mr. MARTIN. That report was made in 1911.

The CHAIRMAN. They do not tell us in there what they investigated on the Tennessee River?

Mr. MARTIN. Yes, sir; it is all here.

The CHAIRMAN. Is it? Their statements thus far are rather of a general nature. Of course it is conceded if on investigation it is found that these reservoir sites are going to cost too much, or that they can not impound enough water, they would not be considered. Some of the reasons they give there I think are good and some of them are not. It seems to me in some of them they are arguing like an attorney who has a bad case, trying to make it as good as possible. They are afraid if we build these dams, for instance, that they will go out some time and kill somebody. That is true of every dam.

Mr. MARTIN. Yes sir.

The CHAIRMAN. If that is going to prevent us we must tear out all the dams we have for any development, either navigation or power, because they are liable to go out some time, and when they do they will do some damage. The same argument would obtain to the railroads, because they kill people sometimes, and it would be sure to do away with the automobile.

Mr. MARTIN. Let us waive the question, for the moment, of safety. The question which he does introduce here is the length of time required for the flow to reach the point of use.

The CHAIRMAN. I do not believe there is anything in that argument. We have dams now in irrigation systems. They know within two hours how long it will take the water which they let out at a certain place to reach another place hundreds of miles below the stream. They can tell accurately just exactly when it is going to get there, and they do it as a practical proposition in irrigation systems.

Mr. MARTIN. Now, consider that this proposed reservoir is 450 miles from the Muscle Shoals——

The CHAIRMAN. Well, I don't know how far it is going to be. It can be that far, and it may be less.

Mr. MARTIN. If you consider that, as disclosed by these reports, then you have for 188 miles distance a fall of 0.96 foot per mile; for 140 miles distance 0.4 of a foot. Your water is going to flow not more than a mile an hour over this distance.

The CHAIRMAN. Yes.

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Mr. MARTIN. So you have got approximately 450 hours to 500 hours. In other words, you have twenty days, we will say, before your water is going to reach the point of use so far as power goes in the Muscle Shoals.

The CHAIRMAN. Yes.

Mr. MARTIN. Then the question is to what extent can you count upon that water 20 days hence being available for generation of power at Muscle Shoals. That is the real question.

The CHAIRMAN. You can count on it to almost a certainty. Of course, in the meantime there might be a storm along the river that would increase the flow a great deal, and there might be a real hot wind and it will evaporate more of it. Those things you will have to contend with. But by a little experience, if we had the dams constructed, we would know absolutely just how much to let out.

Mr. MARTIN. Well, that is a question of whether it can be adjusted to the point of having the water available at the moment when it is needed to produce power to supplement the low stream power.

The CHAIRMAN. Yes.

Mr. MARTIN. That is the problem that was brought forward in these reports. It became evident that this plan was laid to one side and some other plan was sought, and the other plan came along with a consideration of reservoirs, which would not supplement the water flow of the Tennessee, but would supplement the power.

The CHAIRMAN. I am not finding fault with that at all. That is all right. Get power however you can and wherever you can get it the cheapest. But here is a whole lot of possibility in the way of development of power, and a large proportion of that power is secondary.

Mr. MARTIN. Yes, sir.

The CHAIRMAN. If you could equalize the flow of the river just a little bit you could change the secondary into primary power and double its value. Regardless of whatever power you may have to develop in the vicinity, that is a good thing to do, if you can do it.

Mr. MARTIN. You ought to develop the power by these reservoir sites.

The CHAIRMAN. We have the dam constructed, the machinery put in, and everything there. All you need is more water. Sometimes you have too much water and sometimes not enough. If you can devise a scheme by which you can hold it back when you have too much and let it out when you have not enough you are going to be able to utilize the machinery and expensive works that we have already established that must be maintained anyway.

Mr. MARTIN. Of course, when you come to the reservoir sites, if you have a power plant, generate power——

The CHAIRMAN. Yes.

Mr. MARTIN. You will avoid these uncertainties as to whether your water is going to reach the point when needed if you have a power plant at the reservoir site connected with your main power plant by transmission system.

One of the serious questions which would arise right there would be this, that those reservoir sites are located 450 miles, approximately, from the Muscle Shoals development. Then, the question is, where is your load center of the use of that power from the Muscle Shoals going to be. If it is in the direction of these reservoirs, in northeast Tennessee, at an intermediate point, then your reservoir system would have great value. If, on the other hand, your load center is south, your question changes again. That was one of the problems with which the engineers were confronted in their investigation. The load centers, as we feel, and as the later investigations show, would be in Alabama, in the mineral districts.

The CHAIRMAN. Probably you are right about that; but there are great possibilities that at some time Tennessee will use power—Nashville, Chattanooga, and other places that will spring up.

Mr. MARTIN. In the mineral districts, of course, is where the greatest use of power will take place, either at Muscle Shoals or other places.

The CHAIRMAN. You think you could probably manufacture in this district, assuming you would have the power and transportation system?

Mr. MARTIN. Yes, sir.

The CHAIRMAN. And if you develop the navigation and the power together?

Mr. MARTIN. Yes. They would unquestionably develop the country, and you might develop a great manufacturing district at the Muscle Shoals, in which case it is still 450 miles from your reservoir.

The CHAIRMAN. Suppose a manufacturing district developed near Chattanooga. That would be at the head of 6-foot navigation when the navigation

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plans were carried out. Then you would have that located at a more central place.

Mr. MARTIN. If this were the only power that that neighborhood could draw from, that is true. Of course there are a number of powers developed around Chattanooga, and they will always be available at Chattanooga. The Muscle Shoals power will supplement those powers at Chattanooga, but Chattanooga would not depend entirely upon it.

The CHAIRMAN. I suppose it is in time the hope of engineers, modern engineers, is it not, that all these powers will be intertwined so that they will supplement each other?

Mr. MARTIN. Yes, sir.

The CHAIRMAN. It is not going to make so much difference where your power is developed; it will become part of a great system that will extend over a very large section of the country with a view of using all your power all the time.

Mr. MARTIN. Yes, sir; that is true, Senator.

The CHAIRMAN. And that is a great economy.

Mr. MARTIN. I might just mention to you that during the last eight months that very question was very strikingly illustrated in the Southeastern States, where six States with transmission systems are interconnected. There was a power shortage in certain sections. Down in Alabama we did not have the extreme shortage, for instance, that prevailed in the watershed northeast of Atlanta. The result was that our system was able to furnish substantial amounts of power to the Georgia Railway & Power Co. for use in and around Atlanta, in another watershed. It gave us greater use of the water and reached the very question you are suggesting.

The CHAIRMAN. In other words, it was a help to both of you?

Mr. MARTIN. Yes; both.

The CHAIRMAN. That is real economy; that is efficiency.

Mr. MARTIN. In addition to that we used to greater advantage the Warrior steam plant, and that, plus whatever balance of water we had in the Coosa River, enabled us at times to supply the Georgia Railway & Power Co. as high as 30,000 horsepower daily for use in the Georgia district. In addition to that there was still a further shortage of power 600 miles away in the Carolinas, and we were enabled to pass the power on to the Georgia Railway & Power Co., and they in turn to another company, and finally it benefited industries and the public as far as 600 miles away in North Carolina, to industry, cotton mills, and what not, that had been closed, and public utilities, which resumed partial operation on power which came from Alabama.

That is the result of this interconnection.

Going back a moment, then, to this question of the Tennessee River, following the report to which I have referred, document 360, there was another direction to make a still further survey of what could be done with the Muscle Shoals stretch of the river. That investigation and survey led to what is known as House Document No. 20, Sixty-third Congress, second session.

Now, I might mention also that by the rivers and harbors act of March 3, 1909, the Congress authorized the survey of the Etowah, the Coosa, and Tallapoosa River in Georgia and Alabama, and the result of that survey is reported in House Document No. 253, Sixty-third Congress, first session, which is a very interesting document.

The result of House Document 253 was that the Government engineers reported further on certain impounding reservoirs of the Tallapoosa River with a view of benefiting both power and navigation, those reservoirs being within 50 miles of the Alabama River, which it was mainly intended to supplement.

Following that report, then, various of the citizens of Alabama who were interested in this whole Muscle Shoals question, conceived the plan again of developing the Muscle Shoals in coordination with this Tallapoosa River watershed, creating impounding reservoirs on that river and creating power developments there and tying that power development with the power development at the Muscle Shoals on the Tennessee River. A plan was then submitted to the engineers of the United States by the Muscle Shoals Hydroelectric Power Co., which company was one of the companies related in ownership in this proposed scheme of developing the Cherokee situation along with the Muscle Shoals, and a plan was submitted, and on page 34 of this report I will just quote this brief extract:

"The large amount of power developable from water stored in the two reservoirs"—

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One at Cherokee and one at Little River—

"can be called on to make up deficiency in power at the power houses of the Muscle Shoals development during the seasons of low flow. It is this fact alone that enables the power company to plan for a development of the Muscle Shoals potential power to the extent of the ultimate installation proposed, i. e., 680,000 horsepower at the switchboards of the two power houses. * * * The board believes that none of the developments, when taken singly, will be nearly so valuable as a conserver of natural energy as when combined in some such manner as that proposed by the power company. Such a 'combination' of power plants, if suitably 'regulated' by State or Nation, will be of far greater public benefit than a number of independent power plants with incomplete development at each plant."

To illustrate what it would mean to develop these three separately without the supplementing effect of the reservoirs, this report further showed that the proposed saving per year by combining the Muscle Shoals, Tallapoosa, and Little River projects would ultimately amount to 10,000,000 short tons of coal.

The CHAIRMAN. Annually?

Mr. MARTIN. Annually.

Treating these three projects separately and operating them separately would result in a saving of 5,000,000 short tons. It would almost double the effect.

Senator HEFLIN. What does this coal cost at the mines?

Mr. MARTIN. The cost at the present time is $2.35, Senator; from there on up to something over $4.

Senator KENDRICK. What amount of power do you lose in transmission, Mr. Martin? You spoke yesterday of the cost of transmission and the loss of power involved in the long distance. Is there a proportionate amount of loss according to the distance?

Mr. MARTIN. Not necessarily according to distance. It will depend upon the voltage and how many times it may be stepped down. I might mention that the longest distance that our company is transmitting power direct in Alabama is 225 miles from our water-power plant. That goes at 110,000 volts to one station, then is reduced to 44,000 volts and carried 75 miles away at that voltage, and when it gets to the point of use we have lost about 12 per cent.

Senator KENDRICK. And is the loss based upon the distance it must be carried?

Mr. MARTIN. If we were transmitting that power at 220,000 volts we would probably lose 5 per cent.

Senator KENDRICK. Then the distance it must be carried affects only the cost of the transportation line involved in the transmission of the energy?

Mr. MARTIN. Yes. When you get to distances of 400 miles you have about reached the limit for straightaway transmission as now practiced.

Senator HEFLIN. Improved methods of transmission may be used?

Mr. MARTIN. By relaying and interconnected power plants. For instance, we transmitted power last fall in Alabama to one company and that company in turn to another company, all for the purpose of supplementing power 600 miles away.

This combination of power systems which is described in Document No. 20, to which I would refer the committee, shows that there would be approximately 500,000 horsepower prime power which could be made available from the combination of these three developments.

The CHAIRMAN. That is the Tallapoosa, Little River, and Muscle Shoals?

Mr. MARTIN. The Tallapoosa, the Little River, and Muscle Shoals, and it could be expressed in horsepower-hours if that were needed, but I think it does not need to be expressed in that form. Without the combination, and simply taking Muscle Shoals even on the average year, you would have even on the average year no more than 250,000 horsepower prime power. The result is a doubling of the prime power of Muscle Shoals.

Senator KENDRICK. Now, Mr. Chairman, I would like to ask a question there that may have been already included in the record.

The CHAIRMAN. All right.

Senator KENDRICK. Does the Federal Power Commission assume to regulate the reasonableness of the prices that you may charge for this power after you have leased the power plants from the Government?

Mr. MARTIN. It does regulate the rate charged by those who are licensees under the Federal water power act.

Senator KENDRICK. In other words, if the Alabama Power Co. were given the lease to this Muscle Shoals and other plants it would not constitute a monopoly of power in that country?

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Mr. MARTIN. No; because we have no control over the price except in a very limited way. The commission fixes the price. And, Senator, the Federal water power act provides that rates, service, and security issues shall be regulated by the Federal Power Commission if there is no State regulation, and if the power enters into interstate commerce and the States can not agree, then it is regulated by the Federal Power Commission.

Senator HEFLIN. What authority is there in the State of Alabama for regulating power prices?

Mr. MARTIN. There is a very full and complete act of the legislature of 1920 regulating service, rates, and security issues of all public service companies, including water-power companies.

Senator HEFLIN. If you transmit power from Alabama to Georgia, and the authorities in Georgia and Alabama can agree on what the price should be, then the Federal Power Commission would not come in?

Mr. MARTIN. No, sir.

Senator HEFLIN. But if they should not be able to agree, then the Federal Commission comes in?

Mr. MARTIN. Yes, sir. And we are required by the terms of the Federal water power act to agree upon that form of regulation as a condition of the issuance of the license. That is one of the express provisions of the license.

Senator KENDRICK. As one member of the committee, Mr. Martin, it has occurred to me more than once since you began your testimony here that the Federal Government might find it advisable to retain control and ownership of the steam plant at Dam No. 2, for the purpose of making more permanent and secure or dependable the power involved in the secondary horsepower in order to insure, in other words, that it could continue operation in production, we will say, of nitrates; and it occurs to me for that reason it would be a good plan for you to include in your proposition a condition under which the Government might retain the steam plant that it now has, allowing you, of course, or your company, the right to build one of your own in case you should desire to do so.

Mr. MARTIN. Well, we assumed, Senator, in presenting our proposal, that it was in line with what might be the policy of the Government. If that is not in line, then it is necessary to reconstruct that proposal on a line that Congress might declare as its policy.

Senator KENDRICK. I would like that statement.

Mr. MARTIN. I have no doubt that the ultimate conclusion of the bargain could be worked out to carry out the principles of your statement.

Senator KENDRICK. My idea of negotiation is one in which each party involved has a right to change his mind and insist upon having conditions met.

Mr. MARTIN. As I stated, if the Government decides upon a different policy, I have no doubt a different proposition can be worked out. In presenting the plan we had no specifications, so to speak, of what Congress would lay down as its policy and in suggesting a plan we did not in any sense state a plan which was intended to be final or irrevocable. All of these things are subject to change.

Senator KENDRICK. Suppose, after we consider all of the propositions, we concluded yours was more favorable than the others, and we concluded that it would be a wise thing for the Government to retain this enormous investment in the nitrate plant rather than erecting it and junking it, and employ that 100,000 secondary horsepower furnished by your company in the manufacture of these nitrates, and to use this steam plant as an incidental power to make the whole system dependable and economical; then in that event it would be a good idea for you to have a proposition there submitted that would cover that situation.

Mr. MARTIN. Does your suggestion involve the financing of the construction by the Government?

Senator KENDRICK. No; I had in mind, assuming that you want the benefit of the power in the dam, that you will, if you want that, complete that dam, and the Government would be relieved of that; that the Government would be relieved from making any further investment, and would, as of the date of the completion of this dam and its equipment for use, be ready to proceed immediately on the production of this composition or chemical that enters into fertilizer, as an experiment.

Mr. MARTIN. We will be glad to go into the matter to see to what extent we could meet whatever views the Government might lay down. I might mention

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this, Senator, that one thing that is very important here is the use of a large steam plant of that kind in the building up of a load, which would be available in a waterpower when completed. You remember and will bear in mind, of course, that there are large interest charges to be met as the development is completed. We must prepare a load, create a load to meet that interest charge. That is one of the serious reasons why we wanted the right to operate the steam plant.

Senator KENDRICK. Yes, sir; that is all right. My idea was not to deprive you of the use of it until you had replaced it with one of your own, if you found it necessary to do so; but, as I understand it, you are now leasing that plant from the Government?

Mr. MARTIN. Yes, sir; we are leasing that plant to supplement the needs of power in Alabama and to supplement the needs of power in the other Southeastern States during the present year, but that lease is subject to revocation by the Secretary of War at any time.

Senator KENDRICK. It will be very possible for the Government to allow you, under conditions satisfactory that may be included in the contract, to continue the use at least of a part of this power during the time that you require it, if you find it necessary to do so at all in substituting this plant for one of your own.

Mr. MARTIN. There are certain demands for power in the localities which would be reached from Muscle Shoals, running as high as 25,000 to 30,000 horsepower, which must be met within a reasonable time. I have in mind one large community. The operators of the utilities of that community are going ahead—must go ahead—to meet the required needs, to build a new steam plant unless this source of power is made available within some reasonable time, and such operations as that are involved in this whole big problem.

The CHAIRMAN. To what cities do you supply power, or municipalities, for light for houses and for general purposes of lighting, and such power as ironing, washing, etc.?

Mr. MARTIN. There are 63 municipalities in Alabama, Mr. Chairman, that either directly or indirectly receive lighting and power from our system.

The CHAIRMAN. Do you supply them directly through the city systems in Montgomery, for instance?

Mr. MARTIN. No, sir; that community happens to have a local plant, the Montgomery Light & Power Co., in which we have no interest.

The CHAIRMAN. That is another middle man?

Mr. MARTIN. They have their own utilities there.

The CHAIRMAN. And you sell to them?

Mr. MARTIN. Yes, sir.

The CHAIRMAN. And they sell to the city?

Mr. MARTIN. Yes, sir; they sell to the city or, rather, sell to the public.

The CHAIRMAN. Under a charter, I suppose?

Mr. MARTIN. Under a franchise. In other communities we sell to the city as distributors.

The CHAIRMAN. Take one where you sell to the city as distributors.

Mr. MARTIN. Opelika.

The CHAIRMAN. How large a place is that?

Mr. MARTIN. About 10,000.

The CHAIRMAN. What is your charge to the city?

Mr. MARTIN. The standard rate that we charge—I might mention that our lighting rates are 9 cents. That is the highest. In that particular community the charge to the consumer is 12 cents.

The CHAIRMAN. What I am trying to get at is what do you charge? You sell it to the city and the city itself does the distributing?

Mr. MARTIN. Yes.

The CHAIRMAN. And owns the distributing plant, does it?

Mr. MARTIN. Yes.

The CHAIRMAN. Now, then, first what do you charge the city?

Mr. MARTIN. The scale of prices will run on our standard chart of rates something over 1 cent per kilowatt hour. It is somewhere around 8 mills to 1½ cents a kilowatt hour, depending upon use.

The CHAIRMAN. What does the city charge its citizens?

Mr. MARTIN. The city charges for lighting use 12 cents. Tha tis my understanding.

The CHAIRMAN. They must make a tremendous profit?

Mr. MARTIN. The distribution expense is very large.

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The CHAIRMAN. I know something about it, but it ought not to cost that. If you sell to them for less han a cent, and they charge 12 cents, they must be making lots of money.

Mr. MARTIN. They are simply making their interest and operating expenses.

The CHAIRMAN. Do you mean to say that the distributing expense of a city of 10,000 people will amount to as much as 10 cents per kilowatt hour?

Mr. MARTIN. I would not like to say, Senator, that it would amount to as much as that.

The CHAIRMAN. Don't you know that it is true that it does not amount to anything like that in cities that large? I can conceive a city scattered over half a State in which that would be true, but the ordinary city, on the average——

Mr. MARTIN. It probably does not. We charge 9 cents as a maximum anywhere.

The CHAIRMAN. Where you sell to the consumer?

Mr. MARTIN. Yes, sir; that is the maximum rate.

The CHAIRMAN. Then it is a sliding scale, is it?

Mr. MARTIN. Nine cents on down; yes, sir.

The CHAIRMAN. When does it commence to go down. How fast does it go down?

Mr. MARTIN. For the first 100 kilowatt hours, as I recollect, it is 9 cents, then it steps down to 7 cents, then it steps down to 5 cents, and finally, for large users, it goes down as low as 5 mills.

The CHAIRMAN. I suppose you are an expert on that. Do you happen to know what the charge in the city of Cleveland in the municipally owned electric light plant, is?

Mr. MARTIN. I can not qualify as an expert, Senator. I don't know.

The CHAIRMAN. I assumed that you were an expert.

Mr. MARTIN. I do not recall those rates. There are a number of cities in Alabama that have their own distribution systems—several cities.

The CHAIRMAN. And do they all charge their own citizens as high as 12 cents and get it from you at less than 1 cent?

Mr. MARTIN. I don't think there are any towns that charge their patrons less than 12 cents. We are under regulation as to our rates of service and municipalities are not, as you understand.

The CHAIRMAN. Well, I assume municipalities being administered by the people would not make a big profit out of it.

Mr. MARTIN. Well, I don't think they do make a big profit out of it.

The CHAIRMAN. There is something wrong if they pay you for their electricity less than a cent and sell it to their people for 12 cents. There can not be any question about that, it seems to me.

Mr. MARTIN. Well, of course, there are certain expenses which in a large system are distributed over the service to a large number of people, and thereby supply service to the consumer cheaper than a municipality could get it to a limited number of people. You will remember that a city may have 500 users, maybe 1,000, whereas we have, directly or indirectly, 60,000 consumers. That makes a vast difference when it comes to a question of distributing the overhead and general expenses.

The CHAIRMAN. I know in a general way about what the cities over the United States pay, what the consumers pay. Is it not true that there are very few of them that pay as high as 12 cents?

Mr. MARTIN. No, sir; I believe not, Mr. Chairman. We have some communities in our State that charge their public as high as 20 cents per kilowatt hour.

The CHAIRMAN. I can conceive of conditions under which that might be justified, but I am speaking in general, where the normal conditions exist, in the ordinary city. Do you know of any? Even in Washington, where we have an underground system, which everybody concedes is much more expensive than an overhead system, they only charge 10 cents, as I remember it.

Mr. MARTIN. That is operated by a public utility company in Washington.

The CHAIRMAN. Yes.

Mr. MARTIN. Of course, I am not definite in this statement, but I think you will find that public service utilities companies upon the whole charge the public less than a municipal corporation throughout the United States.

The CHAIRMAN. Of course, there may be chances for great disagreement in that respect. I don't believe that. You may be right about it. We will not argue that. But it does not make any difference whether it is a municipality

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or a private corporation, if they are buying their electricity for less than 1 cent per kilowatt hour and selling it to their people for 12 cents, it seems to me they are profiteering. There is something crooked somewhere in it. It does not seem to be possible without some great loophole, some graft in it somewhere. That is more than it is out in the West where we ship the coal two or three thousand miles and make electricity with coal.

Mr. MARTIN. There are a number of municipalities in Alabama that take service from our system, and I think none of them charge the public less than 12 cents.

Senator HEFLIN. Do you supply any city that in turn supplies other cities around it?

Mr. MARTIN. No, sir.

Senator HEFLIN. For instance, you sell power to Opelika, and does Opelika then resell it to Roanoke or Camp Hill?

Mr. MARTIN. No, sir.

Senator HEFLIN. You sell to the municipality direct?

Mr. MARTIN. We sell it direct to Lafayette, your home town, and Opelika.

Senator HEFLIN. You are supplying Lafayette now?

Mr. MARTIN. Yes, sir; and Piedmont, and Sylacauga, and some other towns in Alabama.

The CHAIRMAN. Senator, do you know what the rate is in your town?

Senator HEFLIN. No, sir; I don't. We had our own power plant which operated for a number of years. I don't know whether this arrangement is cheaper than the power we obtained from our own plant or not.

Mr. MARTIN. I think you will find that it is, because your mayor and council were quite anxious for us to come in there and supply them with service. We extended our line from Roanoke to Lafayette and are supplying the city and supplying your cotton mill, and the erection of the cotton mill last year was the result of our going there and making power available.

Senator HEFLIN. Have you got the figures there? Do you know what the figures are?

Mr. MARTIN. I have not the figures here. I can get them.

Senator HEFLIN. I wish you would do that and put them in the record.

Mr. MARTIN. Going back to House Document 20, Mr. Chairman, that document came to Congress in 1914, with the suggestion that unless the proposed plan of development in cooperation with the Muscle Shoals Hydroelectric Power Co. was adopted, that the sum of $150,000 be appropriated for further surveys. The plan was not adopted by Congress, but appropriation of that amount was made, which resulted in further and elaborate study of the question, and that again is reported in House Document No. 1262, Sixty-fourth Congress, first session, which is a most complete report on this whole subject, and again the whole plan of cooperation with the Muscle Shoals Hydroelectric Power Co. was favorably reported, but with the further recommendation that action upon that proposal be suspended until it was determined whether the President would select the Muscle Shoals site, or one of them, for development in connection with the nitrate problem.

In that report it was again specifically recommended that this plan of development go forward in cooperation with the storage development in Alabama, subject to the provision that the President should select the site. The President selected the site. I would like to hand to the reporter certain excerpts from these reports which I will not take the time to read.

The CHAIRMAN. All right.

Mr. MARTIN. The following is a brief summary of House Document No. 20, Sixty-third Congress, first session:

The document consists of a letter from the Chief of Engineers dated May 18, 1914, to the chairman of the Committee on Rivers and Harbors of the House, transmitting a report of the Board of Engineers for Rivers and Harbors on that part of the Tennessee River between Browns Island and the railroad bridge below the city of Florence.

Bids were invited by the board for cooperation by water-power companies in the development and the plan of the Muscle Shoals Hydroelectric Power Co. was recommended as the most advantageous to the United States. Among other provisions the board recommended that some suitable provision should be made whereby the United States would have the right to terminate the water-power lease at any time at the end of 50 years.

The plan proposed by the Muscle Shoals Hydroelectric Power Co. was to develop the Muscle Shoals power in connection with storage plants on the Talla-

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poosa and Little Rivers, and in the course of a letter from Colonel Black, the senior member of the Board of Engineers for Rivers and Harbors, to the Chief of Engineers, of May 5, 1914, it was said, page 5:

"12. The Muscle Shoals Hydroelectric Power Co. has interests in other power developments on the Tallapoosa, the Coosa, and the Little River. Connecting these developments with the proposed Muscle Shoals development will make up deficiency in power at the latter place during the seasons of low water. This fact alone enables the power company to plan for an ultimate installation at Muscle Shoals of 680,000 horsepower, measured at the switchboards. The special board states that such a combination of power plants, if suitably regulated by State or Nation, will be of far greater public benefit than a number of independent power plants, with incomplete development at each plant."

The question was further discussed in the letter from the board of engineer officers to the Chief of Engineers dated February 23, 1914, in the course of which it was said:

"40. *Relation to other developments.*—The studies of the board indicate that when the Muscle Shoals section of the river is considered separately from developments elsewhere the present economical maximum development of the potential power will not greatly exceed that produced by the installations included in the plans of the board. At 72 per cent efficiency the maximum power produced by the suggested installation is about 215,000 horsepower, measured at the switchboard, and with the 80 per cent efficiency assumed by the power company, is about 237,500 horsepower.

"The Muscle Shoals Hydroelectric Power Co. has either under construction or is interested in other developments, viz, at Cherokee Bluffs, on the Tallapoosa, where it is proposed to construct a high dam with available storage capacity of about 50,000,000,000 cubic feet and with working-power head varying from 93 to 146 feet; on the Little River, where it is proposed to form a reservoir with available storage capacity of about 4,800,000,000 cubic feet and with working-power head varying from 515 to 585 feet; and several developments on the Coosa River in connection with the navigation improvement of that stream, one of which (at Lock 12) is now approaching completion. The large amount of water developable from water stored in the two reservoirs can be called on to make up deficiency in power at the power houses of the Muscle Shoals development during the seasons of low flow. It is this fact alone that enables the power company to plan for a development of the Muscle Shoals potential power to the extent of the ultimate installation proposed, i. e., 680,000 horsepower at the switchboards of the two power houses. It is not believed to be necessary to describe in detail the relation of the different power developments proposed by the power company, but in this connection attention is invited to Appendix G, which is the statement furnished to the board by the power company in connection with its proposal. The board believes that none of the developments when taken singly will be nearly so valuable as a conserver of natural energy as when combined in some such manner as that proposed by the power company. Such a 'combination' of power plants, if suitably 'regulated' by State or Nation, will be of far greater public benefit than a number of independent power plants with incomplete development at each plant."

The proposal of the Muscle Shoals Hydroelectric Power Co. was embraced in its letters of December 10, 1913, and January 1, 1914, which are as follows:

MUSCLE SHOALS HYDROELECTRIC POWER CO.
Nashville, Tenn., December 10, 1913.

Col. W. C. Langfitt and Members of the United States Engineer Board on the improvement of the Muscle Shoals section of the Tennessee River, United States Engineer Office, Nashville, Tenn.

SIRS: The Muscle Shoals Hydroelectric Power Co., with further engineering studies and investigations of the joint navigation-power improvement of the Muscle Shoals section of the Tennessee River, conducted during the past six months of extended time granted by your board, by your circular dated 25th of June, 1913, is now pleased and prepared to submit to your board the following suggestions and proposals:

Of the three methods named in your circular as acceptable to you for receiving bids, the Muscle Shoals Hydroelectric Power Co. selects and proposed upon a combination of the first two methods.

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The following bid of this company is based upon lease of 100 years, and for the following reasons:

1. The Muscle Shoals Hydroelectric Power Co., in the light of its own experience, feels that a project of this magnitude, involving such large financial negotiations, can not be financed on any successful basis with a period shorter than 100 years.

2. Hydroelectric, more than any other class of industrial investments, must bear a trying interest burden over a longer nonrevenue initial period of construction.

3. The hazards of a hydroelectric investment are greater than in any other class of investments.

4. In proportion as the lease period is shortened, in like proportion bond issues on such development are with greater difficulty and more expensively negotiated.

5. Electrochemical and electrometallurgical operations, upon which power developed at Muscle Shoals must rely for consumption, require and must secure power at extremely low rates covered by long-period contracts.

In the final preparation of this proposal the Muscle Shoals company has, at its expense, added to the earlier engineering investigations and reports covering a period of six years prior to your circular of June 25, 1913, further studies, surveys, soundings, and estimates, and transmits the result thereof to your board in the form of maps and drawings, trying in its work with the surveys of the Corps of Engineers, United States Army, wherever practicable. The result of the engineering studies and investigations by the Muscle Shoals company during the past six months has confirmed the conclusion suggested to your board of June 24, 1913, that the most feasible and economical plan for the joint improvement of navigation and development of power at Muscle Shoals is with two power dams instead of three, the lower dam being located on the site designated by your board as "No. 2" and the upper dam on the site designated by your board as "No. 4"; the lower dam site, No. 2, to have a crest elevation of 500, with the tail-water at 400.5; the upper dam, at site No. 4, to have an elevation of 540 for the top of the movable crest and 528 for the top of the fixed portion of the dam.

Our engineering studies and investigations, now running over six years, and especially the investigations we have made during the past six months, support the estimate which we have made that the cost of lands, dams, locks, power-house substructures, and miscellaneous and engineering expenses, in connection with these items, together with a contingent and interest fund of $1,000,000, will be $17,349,100. Our plans are based on the gravity dam, sections, adopted by your board for Dams Nos. 2 and 4, and upon unit prices, which we believe, in the light of our recent experience, are more than ample, and which we hope and believe will commend themselves to you as safe.

The Muscle Shoals Hydro-Electric Power Co. respectfully submits to your board the following proposals based upon the conditions therewith stated:

1. That the Government shall complete the dam at site No. 2 and the appurtenances thereto mentioned above and permanently raise the waters behind the said dam to the level of the spillway thereof within four years after the date of the first appropriation made for the carrying out of the project and not later than the 1st of January, 1919, and for a sufficiently long period of time prior to that date give entrance to the Muscle Shoals Co. for the completion by it at its expense of the power-house superstructures and the initial hydraulic and electrical equipment by that time.

That the Government shall complete the dam at site No. 4 and the appurtenances thereto mentioned above and permanently raise the waters behind the said dam to the level of the spillway thereof within five years after the date of the first appropriation made for the carrying out of the project and not later than the 1st of January, 1920, and for a sufficiently long period of time prior to that date give entrance to the Muscle Shoals Co. for the completion by it at its expense of the power-house superstructures and the initial hydraulic and electrical equipment by that time.

2. The Muscle Shoals Co., upon the completion of the dam at site No. 2 and the appurtenances mentioned above and the permanent raising of the waters behind said dam to the level of the spillway thereof, will pay to the Government the sum of $3,000,000 in cash as its first contribution to the cost of the lands, docks, dams, and substructures.

3. The Muscle Shoals Co., within a period of 100 years from the completion of the dam at site No. 2 and appurtenances thereto mentioned above and the

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permanent raising of the waters behind the said dam to the level of the spillway thereof, will repay to the Government as its second contribution for lands, locks, dams, and substructures $7,000,000 by an annual payment of sinking fund and interest, taken at the approximate rate of 3 per cent per annum and in specific amounts, to be paid as follows:

At the end of the first year after the completion of the dam at site No. 4 and the appurtenances thereto mentioned above and the permanent raising of the water behind said dam to the level of the spillway thereof	$75,000
At the end of the second year	125,000
At the end of the third year	150,000
At the end of the fourth year	175,000
At the end of the fifth year	200,000
And each year thereafter to the close of the 100-year period	240,000

4. The Muscle Shoals Co., as its third contribution in aid of navigation, will pay to the Government each year an amount equivalent to 30 cents per horsepower of installed capacity measured on the switchboards of the power house. Such payments shall begin at the end of the first year after the said installed capacity shall exceed 200,000 horsepower, but not later in any event than at the end of 20 years from the beginning of the said 100-year period, and shall continue to the end of the said period.

5. The Muscle Shoals Hydro-Electric Co., upon the invitation of the United States Government at any reasonable time prior to the expiration of the said period of 100 years, will undertake negotiations with the Government looking to a renewal of this lease. In the event of failure to agree upon terms this lease shall terminate at the end of said period of 100 years, and the Government shall then take possession of all the property of the Muscle Shoals Co., the value of which may be dependent upon the right to develop water power under this lease, and shall pay to the Muscle Shoals Co. a price which may have been previously agreed upon between the parties, or in the event of failure to so agree the Government shall pay for such property a fair value, to be determined by condemnation proceedings usual in the States wherein the property is located. The Government, furthermore, on taking possession shall assume all the contract of obligations of the Muscle Shoals Co. that may have been previously submitted by the Muscle Shoals Co. to the Government for approval and which within a reasonable time after such submission have not been disapproved of by the Government.

6. Repairs, maintenance, and operation of dams, power houses, substructures, superstructures, machinery, and appliances shall be at the expense of the Muscle Shoals Co. during the 100-year period. Repairs, maintenance, and operation of the locks shall be at the expense of the United States Government during the 100-year period.

7. The Muscle Shoals Co. will furnish the United States, free of charge, delivered to the lock grounds, electric power not to exceed 100 horsepower.

The board has asked that each bidder shall inclose with his proposal sufficient evidence to show what financial backing he may have, in order to enable the board to give proper weight to his proposal. The financial interests which are the support of the Muscle Shoals Hydro-Electric Power Co., and the owners of its securities, are engaged on a large scale in the development and operation of water powers in South America, Mexico, United States, and Canada, and as large investors in industries requiring great amounts of hydroelectric energy. Their developments of this nature going forward at the present time involve an investment of about $15,000,000. Representatives of the company will be pleased to state verbally to your board on presentation of this proposal such additional definite information as can not properly be conveyed in a document of a more or less public nature.

We believe it is proper and pertinent to call the attention of the board to what we conceive to be the three factors of exceptional strength involved in this company's proposal.

1. It is a plan by which, through the development of water power, the United States Government is repaid all of its expenditures for navigation and water-power development and becomes the sole possessor of all the things for which that expenditure was made.

2. It is a plan by which the normal high-water flow of the stream is conserved to an extent which makes feasible the development of two or three times as

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much power at Muscle Shoals as could otherwise be developed. This is possible only through combining with the Tennessee River development, subject each hour of the day to the vagaries of the flow of that stream, this company's proposed water-power developments on the Tallapoosa and Little Rivers, with their extraordinary storage reservoirs. It is estimated that the maximum installed capacity practicable by these combined developments will be approximately 680,000 horsepower, while that practicable by the use of the waters of the Tennessee River at Muscle Shoals alone would be approximately 200,000 horsepower. Under this plan of combination the normal high-water flow of the Tennessee River at Muscle Shoals is conserved, which under any other plan of development would reduce the available developed power to dependence upon the low-water flow.

3. This plan contemplates the application of a material part of the power to be thus developed to the manufacture of an agricultural fertilizer through the fixation of atmospheric nitrogen, an industry in which there has been in four years of commercial life approximately $60,000,000 invested, and for the development of which the fundamental requirement is cheap, continuous power and plenty of it.

If the joint navigation-power development at Muscle Shoals can be accomplished so that there will result a large volume of continuous cheap power, the manufacture of agricultural fertilizers through the fixation of atmospheric nitrogen should be possible on a scale adequate to afford the farmers of this great country advantages comparable to those enjoyed by European farmers.

If the board feels possibly that the Muscle Shoals Hydro-Electric Power Co. has in its proposal gone beyond the limitations of the resolution passed by Congress under which the board is working, we rest our excuse, if any be needed, upon purpose No. 2 of the joint resolution passed by Congress authorizing the creation of your board by the War Department.

Respectfully submitted.

MUSCLE SHOALS HYDRO-ELECTRIC POWER CO.,
J. W. WORTHINGTON, *President.*

MUSCLE SHOALS HYDRO-ELECTRIC POWER CO.,
Nashville, Tenn., January 1, 1914.

Col. W. C. Langfitt and Members of the United States Engineer Board on the Improvement of the Muscle Shoals Section of the Tennessee River, United States Engineer Office, Nashville, Tenn.

SIRS: This communication is proposed to your board as an addendum to the proposal made to your board by the Muscle Shoals Hydro-Electric Power Co. under date of December 10, relative to cooperation between the United States Government and the Muscle Shoals Hydro-Electric Power Co. for the joint navigation power improvement of the Muscle Shoals section of the Tennessee River.

The estimates submitted by the Muscle Shoals Hydro-Electric Power Co. accompanying its proposal of December 10 did not include, and we did not intend our proposal to include, the cost of the navigation dam designated by your board as Dam No. 1, with location just above the Florence Bridge, estimated to cost approximately $1,000,000.

In submitting this amendment to our proposal of December 10, the Muscle Shoals Hydro-Electric Power Co. proposes as follows:

1. That if Dam No. 1 may be used in a dual capacity, chiefly and necessarily for navigation, and contingently establish a regulation pool below the navigation and power dam at site No. 2, the Muscle Shoals Hydro-Electric Power Co. may have the right to use such regulating pool.

2. In consideration of the use of the pool to be formed behind Dam No. 1, the Muscle Shoals Hydro-Electric Power Co., at its third contribution in aid of navigation, will pay to the Government each year an amount equivalent to 35 cents per horsepower of installed capacity measured on the switchboards of the power houses, instead of 30 cents per horsepower as provided in our original proposal of December 10.

3. The Muscle Shoals Hydro-Electric Power Co. will furnish to the United States free of charge, delivered to the lock grounds of Dam No. 1, electric power not to exceed 50 horsepower, for the operation of the navigation facilities at Dam No. 1. All repairs, maintenance, and operation of Dam No. 1 and the lock appurtenant thereto shall be at the expense of the United States Government.

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In all other respects this addendum to our proposal of December 10 shall subscribe to all of the conditions set forth in that proposal.

Respectfully submitted,

MUSCLE SHOALS HYDRO-ELECTRIC POWER CO.,
J. W. WORTHINGTON, *President.*

Congress having provided funds for a further survey of the situation, the reports of such survey were transmitted to the House in Document No. 1262, Sixty-fourth Congress, first session, being a letter from the Secretary of War to the Speaker, as follows:

[House Document No. 1262, Sixty-fourth Congress, first session.]

TENNESSEE RIVER BETWEEN BROWNS ISLAND AND FLORENCE, ALA.

WAR DEPARTMENT,
Washington, June 28, 1916.

The SPEAKER OF THE HOUSE OF REPRESENTATIVES.

SIR: I have the honor to transmit herewith a letter from the Chief of Engineers, United States Army, dated 26th instant, together with copies of reports from Maj. H. Burgess, Corps of Engineers, dated April 5, 1915, and March 22, 1916, with maps, on preliminary examination and survey, respectively, of Tennessee River, between Browns Island and the railroad bridge below the city of Florence, Ala., made by him in compliance with the provisions of the river and harbor act approved March 4, 1915.

Very respectfully,

NEWTON D. BAKER, *Secretary of War.*

"WAR DEPARTMENT,
"OFFICE OF THE CHIEF OF ENGINEERS,
"*Washington, June 26, 1916.*

"From: The Chief of Engineers, United States Army.
"To: The Secretary of War.
"Subject: Preliminary examination and survey of Tennessee River between Browns Island and the city of Florence, Ala.

"1. There are submitted herewith, for transmission to Congress, reports dated April 5, 1915, and March 22, 1916, with maps, by Maj. H. Burgess, Corps of Engineers, on preliminary examination and survey, respectively, authorized by the river and harbor act approved March 4, 1915, of 'Tennessee River between Browns Island and the railroad bridge below the city of Florence.'

"2. The part of the river covered by these reports is generally known as the Muscle Shoals section. The improvement of this section by the United States in cooperation with water-power interests has been under consideration for some years; and an exhaustive report, published as Committee Document No. 20, Sixty-third Congress, second session, contains favorable recommendations for such an improvement at an estimated cost of $18,701,000, of which approximately $8,575,000 was considered as representing the value of the improvement to navigation, the remainder being chargeable to power development and to be reimbursed to the United States. The information then available was considered sufficient for a general estimate of cost and a determination of the advisability of the United States adopting the project, but was not sufficient for the final selection of sites and the making of detailed estimates of cost.

"As a result of the present survey, the district officer suggests a few minor changes in the plans, the most important being the selection of a new site for Lock and Dam No. 2. The estimate of cost is increased from $18,701 to $19,000,000. He also submits an alternative plan which would permit the development of about 82 per cent of the power that would be available under the first proposition. This plan is estimated to cost $16,000,000, but is not favored by the district officer if flowage rights for the original plan can be secured at a reasonable cost. His recommendations are as follows:

"'1. That provision be made by Congress for the improvement of the Muscle Shoals section of the Tennessee River for the combined purpose of providing suitable navigation facilities and for the development of power in cooperation with the Muscle Shoals Hydro-Electric Power Co.; (2) that a cash appropriation of $5,000,000 be made, and that the Secretary of War be authorized to contract obligations for such material and work as may be necessary to com-

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plete the proposed improvement, to be paid for as appropriations may from time to time be made by law, not to exceed in the aggregate $11,000,000, exclusive of the initial appropriation of $5,000,000; (3) that the Secretary of War be authorized to adopt either the plan of improvement first described or that designated as the alternative plan, depending upon whether satisfactory terms can be reached with the riparian owners in Basin No. 3; (4) that the Secretary of War be authorized to enter into a contract with the Muscle Shoals Hydro-Electric Power Co. for cooperation in the proposed work of improvement and for a lease of the power developable at the proposed power houses, under terms proposed by the company in its offer of December 11, 1913, or under such modified terms as may be agreed upon which are equivalent in value to the United States or which may be made necessary by reason of the selection of the alternative plan; (5) that the Secretary of War be authorized to enter into a contract with the Muscle Shoals Hydro-Electric Power Co., under such terms, as may be agreed upon, or to do the work by the hired-labor method; and (6) that the Secretary of War be authorized to retain in the service until the completion of the work all satisfactory employees who may be appointed because of lack of civil-service eligibles at the time of employment, without regard to the subsequent establishment of a register of eligibles.

"'The division engineer concurs in the opinions and recommendations of the district officer.

"'3. These reports have been referred, as required by law, to the Board of Engineers for Rivers and Harbors, and attention is invited to its report herewith, dated May 24, 1916. The board states that while the results of the detailed survey and the further study based thereon suggest some minor modifications in the project already before Congress, the report is in all essentials corroborative of the earlier one and presents nothing to change the opinion expressed therein that it is advisable for the United States to take this opportunity of entering into an arrangement with the Muscle Shoals Hydroelectric Power Co. whereby this serious obstruction to navigation on the Tennessee River will be overcome and at the same time one of the greatest natural resources of the country will be conserved. The board invites attention, however, to the provisions contained in section 124 of the act to increase the efficiency of the Military Establishment of the United States approved June 3, 1916, respecting the establishment of nitrate plants to supply Government needs in the manufacture of explosives for military uses, and in view of this legislation it recommends that action on the proposed contract with the Muscle Shoals Hydroelectric Power Co. be suspended until it has been determined whether the Muscle Shoals power will be utilized for such a nitrate plant. If this question is decided in the negative, the board is of opinion that the proposed improvement for combined navigation and the power purposes is advisable substantially as proposed by the district officer.

"'4. After due consideration of the above-mentioned reports, I concur in the view of the Board of Engineers for Rivers and Harbors, and therefore recommend that action on the proposed contract with the Muscle Shoals Hydroelectric Power Co. be suspended until it has been determined whether the Muscle Shoals power will be utilized for a nitrate plant. If this question be decided in the negative, and the improvement by the United States of "Tennessee River between Browns Island and the railroad bridge below the city of Florence," is deemed advisable in cooperation with the Muscle Shoals Hydroelectric Power Co. at a total estimated cost of $19,000,000, substantially in accordance with the recommendations of the district officer as given above, and in this case it is recommended that the first appropriation be $5,000,000 and that continuing contract be authorized covering the balance necessary to complete the project.

"'W. M. BLACK,

"'*Chief of Engineers, United States Army.*'"

The subject was again reviewed at great length by the district engineer and the Board of Engineers for Rivers and Harbors and the cooperative plan recommended in document 20 reaffirmed, the following quotation being from the letter of Maj. H. Burgess, the district officer, to the Chief of Engineers, of April 5, 1915 (p. 11):

"15. The question of the development and utilization of water power in connection with this improvement is its essential feature, and since this has already been fully treated by the board's report of February 23, 1914, it would seem unnecessary to discuss the matter further. It will suffice to state here that the radical improvement of this section of the river appears to rest on the economical

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practicability of cooperation between the power interests and the navigation interests."

The report on the preliminary examination of the Tennessee River, made by Major Burgess, was forwarded to the Chief of Engineers, by Col. (now General) Lansing H. Beach, the division engineer, with his indorsement, dated April 17, 1916, "concurring in the opinions and recommendations of the district officer," which in part are as follows:

"Excerpts from report on preliminary examination of Tennessee River, between Browns Island and Florence, Ala., dated April 5, 1915, from Maj. H. Burgess, Corps of Engineers, district engineer's office, Chattanooga district, to the Chief of Engineers, United States Army, forwarded, concurring in the opinion and recommendations of the district engineer, by Lansing H. Beach, colonel, Corps of Engineers, division engineer (pp. 40–41, 43):

"'82. The benefits to result, then, from combining the Muscle Shoals power development with the storage plants on the Tallapoosa and Little River systems is the increase of primary power from 100,000 to 280,000 horsepower, and of 10 months' secondary power from 115,000 to 210,000 horsepower; and of being able to use the potential energy at Muscle Shoals, a total of about 3,330,000,000 horsepower hours per year, as against a probable utilization of only about 2,020,000,000 horsepower hours per year for the independent plants (assuming that 9 months' secondary power is developed).

"'83. The importance of the combination of power plants may possibly be emphasized by showing the annual expenditure of coal required for producing an equivalent amount of electrical energy. The latest and most efficient type of steam-power plants show a consumption of coal of approximately 1½ pounds per horsepower hour. It may be assumed that improvements will reduce this to 1 pound per horsepower hour. On this assumption, the annual output of electrical energy for the independent development of Muscle Shoals is equivalent to the consumption of 1,010,000 tons of coal per year, and the annual amount of potential power at Muscle Shoals utilized under the combination of power plants is equivalent to an annual consumption of 1,665,000 tons of coal per year. The waste of the coal supply of the United States resulting from the failure to utilize to the greatest practicable extent the potential water power at Muscle Shoals would, therefore, be approximately 650,000 tons per year.

"'84. It does not seem reasonable that such great benefits should be lost for the fear of possible evils to result from large power combinations. There is no doubt that either the United States Government or the State government should control such combinations of power for the purpose of regulating rates to consumers; but combinations that produce enormous saving of energy, which otherwise would be wasted, ought to be encouraged rather than forbidden. True conservation requires the utilization without waste of all natural resources, and here at Muscle Shoals there will be enormous wastage if this run-of-the-river power can not be combined with plants having facilities for storing great quantities of water to make up for the shortage at Muscle Shoals during times of low water.

"'85. Another great benefit from the combination of power plants which is sometimes lost sight of is the elimination of duplications of expensive transmission lines, transformers, and other equipment necessary for distribution of power. Since interest must needs be paid by some one on the extra capital invested in the duplication of equipment, it follows that the actual cost of placing power on the switchboard of the consumer is greater for separate developments than for combined plants. It is true that competition may result in the consumer paying less for power under the supposition of separate developments than in the case of combinations, and it is for this reason that it is desirable to so regulate rates of power combinations that most of the benefit of cheap production of power shall revert to the consumer rather than to the stockholder of the power company.

"'93. It is not true conservation of natural sources which forbids their development on the plea that the State or General Government is not obtaining full value for the grant of privileges. There is little doubt that franchises for power developments should be for limited periods, so that the people may again take over their property and provide for its future operation under conditions suitable to the time when the limited franchise has ended. It is equally certain that the interests of the people demand a regulation of rates to the consumer, so that the company which has been granted the franchise for operat-

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ing a property belonging to the people may not obtain an undue profit at the expense of the owners. Assuming such regulation, it is unimportant whether or not any payment is required to be made to the State or General Government, or what the size of such payment shall be. In any event, under the assumed regulation of rates, whatever amount is charged to the power company is paid by the consumer, and the collection of such amount is merely an exercise of the taxing power of the Government. It seems reasonable, therefore, that the present plan, which contemplates the navigation improvement of this section of the river and a more complete utilization of the potential power than seems practical by any other combination of plants, and which can be secured under fair and reasonable terms, ought to be adopted, rather than to have this power continue to be wasted for many years and to have through navigation remain unobstructed by these shoals, on the ground that delay may result in securing somewhat better terms from some other power company proposing to cooperate.' "

Mr. MARTIN. The President selected these Wilson Dam sites, and thereupon, on February 18, 1918, the Alabama Power Co., which was the owner, through the Muscle Shoals Co., of the Wilson Dam site, addressed the following to Col. C. Keller, of the Corps of Engineers, in which it agreed to donate the Wilson Dam site to the Government for development in connection with the nitrate problem:

ALABAMA POWER CO.,
Birmingham, Ala., February 18, 1918.

Col. C. KELLER,
Corps of Engineers, United States Army, Washington, D. C.

SIR: Following the several interviews which I have had with you recently on the subject of the desire of the Government to acquire from the Muscle Shoals Hydroelectric Power Co. the dam site and certain other properties at Muscle Shoals, I have conferred fully not only with the directors of that company but also with the representatives of the security holders of the Alabama Traction, Light & Power Co. (Ltd.). As I believe I explained to you the last-mentioned company is interested by reason of its stock holdings in Alabama Power Co., which latter company owns the stock of the Muscle Shoals Hydroelectric Power Co.

The properties in question represent a very heavy investment by our company and have occupied an important position in our plans for securing power for the future. For several years we have worked on plans for ultimately developing these water powers as an integral part of the hydroelectric system which will be required by our companies to meet the needs of the communities which they serve. Much of this work was done by us in collaboration with the Army engineers looking toward a development in cooperation with the Government on some such plan as was favorably reported on by the Army engineers in House Document No. 1262, Sixty-fourth Congress, first session.

I am adverting very briefly to these features as I judge from the several interviews which I have had with you and with other representatives of the Government that you are fully aware of what the company has done in preparation for the ultimate development of this waterpower, and I believe you appreciate that it should receive consideration in the disposition of any surplus power not required for the needs of the Government.

From our recent interviews it is obvious that our respective views as to the value of our property and the price which you would agree to pay are quite irreconcilable. As directors of a large public-service corporation we have always believed that in addition to the development of our waterpowers at Muscle Shoals being a very valuable and necessary complement to our system throughout the State, the large industrial community which would grow up at Muscle Shoals would add a special value to that power plant. In times like these, however, such considerations must be secondary to the urgent need of the Nation to secure these properties immediately for the carrying out of the Government project for the production of war nitrates, and we have accordingly determined to donate our lands to the Government for this purpose. I have already given instructions to the company's attorneys for the preparation of the necessary deeds of conveyance.

It is our understanding from you that the Government only desires to acquire the site at Dam No. 2 and adjacent properties, with flowage easement on such of our other properties as may be affected by this development.

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I need hardly assure you of the desire of the company to cooperate with the War Department to the fullest extent in placing at your disposition the benefit of all our engineering studies and records relating to the projected development.

I trust that this disposition of the matter meets with your views.

Yours very truly,

JAMES MITCHELL, *President.*

That letter was acknowledged by the Secretary of War, Mr. Baker, on February 20, 1918, as follows:

WAR DEPARTMENT,
Washington, February 20, 1918.

Mr. JAMES MITCHELL,
President Alabama Power Co., Birmingham, Ala.

DEAR SIR: Referring to your letter of the 18th instant, addressed to Colonel Keller, in which you express the willingness of your company to donate to the United States certain properties and flowage easements needed for the proposed Federal power development at Muscle Shoals, I beg to acknowledge with thanks the company's generous and public-spirited action.

The further steps necessary in regard to the matter will be given immediate attention.

Very respectfully,

NEWTON D. BAKER,
Secretary of War.

That site is now the Wilson Dam site, and while we received from the Government its check for $1, we had expended in our various efforts to make the development slightly less than $500,000.

The CHAIRMAN. You mean that you gave to the Government for $1 property that cost you $500,000?

Mr. MARTIN. Yes, sir. We were in negotiation with Colonel Keller and other officers of the Army with respect to the terms of the donation, terms of the conveyance to the Government. We were unable to agree promptly upon terms. The War Department was desirous of going forward with this development in connection with the war program, and that was the basis on which the negotiations were proceeding. We were asked not to delay the war program, but to aid it. We did it. We agreed to aid the war program, and waive the question of compensation, and we conveyed it to the United States without any compensation outside of the $1.

The CHAIRMAN. And without any agreement that it should be taken up afterwards?

Mr. MARTIN. Yes, sir; there was no agreement about it.

Following the conveyance to the Government, under date of April——

The CHAIRMAN (interposing). I wish you would, in a general way, not directly, but in a general way, outline now what this property consisted of that you donated to the Government.

Mr. MARTIN. The lands at either abutment site which you saw, and certain overflowed lands.

The CHAIRMAN. About how much was there of that?

Mr. MARTIN. I can not give you the acreage right now.

The CHAIRMAN. You say you had expended $500,000. Was that in acquiring this property?

Mr. MARTIN. Not only of the acquired lands, but we had spent a good deal of money in engineering and investigation, borings, plans, and general overhead charges.

The CHAIRMAN. Did your company make the borings at Dam No. 2?

Mr. MARTIN. Some of them. The Government made most of them.

The CHAIRMAN. Did the Government utilize or rely on the borings that you had made?

Mr. MARTIN. Well, yes. We turned over to the Government all our plans, investigations, and everything we had done.

The CHAIRMAN. What I am trying to get at, Mr. Martin, is just what the value of the property was to the Government that it acquired of you for this $1.

Mr. MARTIN. Well, it is a difficult matter to get at the value.

The CHAIRMAN. Yes; it would be to get it definitely, but I would like to get it in round numbers, as near as I can.

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Mr. MARTIN. I could only say this: This Muscle Shoals Hydro-Electric Power Co. was formed by citizens of Alabama in 1906. They worked in an effort to develop the property until they sold it out in 1912, and the purchasers continued in their efforts to develop it, putting more money into lands, investigations, general expenses, salaries of men and officers, in connection with the whole subject, until at the time of the donation in 1918 there was charged against this development slightly less than $500,000 as the cost from 1906 to date.

The CHAIRMAN. Do you know how many acres of land was conveyed to the Government?

Mr. MARTIN. I do not know. The question of acreage of land is not so important, because the property the company owned was the abutment sites.

The CHAIRMAN. I understood when we were there that you owned the abutment sites. That is the land on each side of the river where the dam is located. How much land did you own there?

Mr. MARTIN. Several hundred acres. I don't recall, Senator, now, without looking it up.

The CHAIRMAN. For instance, on the south side, where the buildings are and where the railroad track was built, you owned all that land, did you?

Mr. MARTIN. Yes, sir.

The CHAIRMAN. Did your company make any of the improvements back on the river where they had borings to ascertain the condition of the rock?

Mr. MARTIN. We made no improvements, Senator; no construction in the way of buildings.

The CHAIRMAN. In the work there back from the river quite a ways, some places there are borings made. It seems that at the abutments crevices were discovered in the rock, some of them quite large, that you could plainly see, that a man can walk in, big holes in the rock. That work had not been done by your company, had it?

Mr. MARTIN. No, sir.

The CHAIRMAN. It was necessary to fill those all up, to go far enough in until you got solid rock?

Mr. MARTIN. Yes, sir. You will find on investigation of the plans and specifications under which this work began that we turned over to the Government, that they bear the signature and approval of the chief engineer of our company, and many of which the Government made use of, and many of which were changed. We had worked out very definite plans, and in negotiation with the Government engineers they were all presented to the Government. While changd oftentimes, many of them were accepted as the basis on which development would go ahead.

Senator HEFLIN. Mr. Martin, at the time you conveyed this property to the Government, did you not have it specified in the contract that if the Government at any time decided to get rid of it, it would give you an opportunity to get it back?

Mr. MARTIN. No, Senator. We discussed the matter fully with Senators Bankhead and Underwood and with the Government engineers and it was understood and discussed that we naturally would want to negotiate if the Government should want to put the power in commercial use. The form and terms of the deed were also fully discussed, but our future connection with the situation was left in the form of mere discussion.

Senator HEFLIN. I may have it confused with some of the other property.

The CHAIRMAN. You may have it confused, Senator, with the Gorgas plant. There there was such a plan put in writing.

Senator HEFLIN. That was the Gorgas plant and not the Wilson Dam?

Mr. MARTIN. Yes, sir.

Senator HEFLIN. Well, that is it. I had it confused.

Senator KENDRICK. Do you recall, Mr. Martin, whether you transferred to the Government absolute title to all the lands in the neighborhood of the abutments of the dam, the ends of it?

Mr. MARTIN. Yes, sir; in connection with Dam No. 2 we did. We went over the subject fully and elaborately and prepared deeds, and that was under discussion for some time as to just exactly the terminology of the deed. It was over a year before we got the formal deed satisfactory to the Government, and——

Senator KENDRICK. And without reservation?

Mr. MARTIN. Without reservation. Of course we have the Dam No. 3 site.

Senator KENDRICK. That is 35 miles up the river?

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Mr. MARTIN. Yes, sir; and we have some other properties in those communities which do not constitute a part of the No. 3 development. Wherever there was any property needed for development purposes we conveyed it.

Senator KENDRICK. At Dam No. 3, according to a map shown us while we were there on the bank of the river, it has been thoroughly drilled, apparently clear across the river, and as I remember, two rows of drill holes. Did the Government do that drilling or did you do it?

Mr. MARTIN. The Government did all of it under the $150,000 appropriation in 1915.

The CHAIRMAN. That is about the extent to which the Government has gone, as far as Dam No. 3 is concerned, is it not?

Mr. MARTIN. Yes; except plans have been made.

The CHAIRMAN. Plans, I presume, have been made. Borings have been completed clear across the river?

Mr. MARTIN. Yes, sir; the plans which were made in cooperation with our company in 1915 and 1916 are the plans that we understand are the present plans for that development.

Now, there is one other letter that I would like to call attention to, and that is our letter to the Chief of Engineers in reply to the letter which the Chief of Engineers wrote us under date of April 2, 1921. He wrote us, as he wrote to many others, to know what arrangements could be made to derive a reasonable return upon the investment if the United States completed the dam and hydroelectric power plant at Muscle Shoals.

We replied to the letter of the Chief of Engineers under date of May 28, 1921, which reply I would like to file in the record, in which we reviewed our connection with this project and stated that we regarded the undertaking as economical and profitable under the conditions under which we made our former proposal, and stated that we were prepared to go forward and work out a plan of cooperation with the Government if it was desired to place a part of this power in commercial use. We did not in that letter fix any definite basis on which we would proceed, but we left it in general terms.

(The letters referred to are as follows:)

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, April 2, 1921.

ALABAMA POWER CO.,
Birmingham, Ala.

GENTLEMEN: 1. The Secretary of War has directed me to ascertain what arrangements can be made to derive a reasonable return upon the investment if the United States completes the dam and hydraulic power plant at Muscle Shoals, Tennessee River.

2. If you are interested, I would be pleased to discuss the matter with you at this office at the earliest date that may be mutually determined.

3. It is desired to develop the matter and come to a conclusion at as early a date as possible.

Very truly yours,

LANSING H. BEACH,
Major General, Chief of Engineers.

ALABAMA POWER CO.,
Birmingham, Ala., May 28, 1921.

Maj. Gen. LANSING H. BEACH,
Chief of Engineers, Washington, D. C.

DEAR SIR: We duly received your communication of April 2, 1921, inquiring what arrangements can be made to derive a reasonable return upon the investment if the Government completes the dam and hydraulic power plant at Muscle Shoals, Tennessee River, and you invite a discussion of the matter if we are interested.

We have given the subject of your letter careful consideration since its receipt and wish to make a reply as follows:

1. The site at which the dam is being constructed on the Tennessee River was purchased by our company in 1906, and from that time until 1918, a period of 12 years, we expended large sums of money in making studies, exploring foundations, and in the purchase of reservoir lands, with the view of its development as an integral part of the hydroelectric system which would be required to meet the needs of the communities which the company proposed

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to serve from time to time. It was our plan to construct storage reservoirs and to connect them with the proposed Muscle Shoals development to make up the deficiency in power at the latter place during seasons of low water. This fact alone would have enabled this company to plan for an ultimate installation at Muscle Shoals largely in excess of the installation that should be made as an independent, separate development. In short, our plans were adapted to fully conserve and utilize in the public interest the navigation and water resources of the region.

2. In the meanwhile we acquired other power sites in Alabama, and under an act of Congress of 1907 constructed a dam and power plant on the Coosa River, a smaller hydro plant on a nonnavigable stream, and several steam plants at different points on our system, with a total capacity of 177,400 horsepower (not including the Government steam plant at Warrior). This system embraces about 1,500 miles of high-tension lines, over which we are distributing energy to the public in more than two-thirds of Alabama, including one of the greatest industrial and mining districts in the country.

3. During the same period the engineers of the United States were investigating the project pursuant to the direction of Congress. A special board of engineers was created for the purpose of obtaining information and estimates relative to the coordination of proposed improvements for navigation and water power, and that board invited bids for cooperation by water power interests in the proposed development. This company, through its subsidiary, Muscle Shoals Hydroelectric Power Co., submitted a plan in response to that invitation of the United States Engineers. Plans were also submitted by others, but upon careful investigation the special board recommended that Congress undertake the improvement in cooperation with this company, and that recommendation was concurred in by the Board of Engineers for Rivers and Harbors and by the Chief of Engineers. Believing that this was an economical and profitable undertaking, we were prepared under the conditions then existing to proceed with our share of this undertaking and if this recommendation had been favorably acted upon, the project would have been available for the manufacture of nitrates during the war period, and many millions of dollars would have been saved.

4. A further examination and survey of the project was made by the engineers of the United States in compliance with the provisions of the river and harbor act, approved March 4, 1915. Recommendation was again made that the improvements be undertaken in cooperation with this company, but the engineers further recommended that action be suspended until it should be determined whether the Muscle Shoals power would be utilized for a nitrate plant under the act of Congress of June 3, 1916. (Doc. No. 1262, 64th Cong., 1st sess., 1916.)

5. We are adverting to these matters in order that you may see that we were for a number of years interested in working out a feasible plan for the development of the Muscle Shoals power for general industrial use on lines of coordination with improvements for navigation. However, in 1918–19, this particular site was selected for development by the United States to supply power for a nitrate plant; and as it seemed that the United States needed to go forward quickly in its war program to make provision for nitrates, we concluded as the result of various conferences with representatives of the Government to donate to the United States the dam site and other lands owned in fee by this company, leaving entirely to the Government the question of any plan for future cooperation with the United States. This donation was made and we received from the United States its voucher for the sum of $1, being the nominal consideration expressed in the deed. As you may recall, the donation was accepted in behalf of the United States by the Secretary of War, under date of February 20, 1918, who expressed the thanks of the Government for the company's action in so donating the property. The property thus donated represented on our books a total investment by this company, to the time of the donation, of approximately $476,000, but we desired to be helpful to the Government in its war program and made the donation in that spirit. From that time until the receipt of your letter, we have taken no action with regard to the Muscle Shoals project other than the interest common to every patriotic citizen to encourage the progress and development of the Tennessee River Valley and the contiguous country.

6. We do not wish to suggest a course contrary to the expressed purpose of Congress that all of the Muscle Shoals power shall be used in the manufacture of nitrates or other products needed for munitions of war and useful in the

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manufacture of fertilizer and other useful products. Practically all of the electrical power used in industrial and mining operations in Alabama is furnished by this company, in addition to which we supply the lighting and other municipal requirements in more than two-thirds of the State; and if, in the wisdom of Congress all of the power at Muscle Shoals should be reserved for nitrate purposes, or applied to any other use considered to be of greater benefit than the public service rendered by this company, we will continue our program to develop other water powers as the public may require.

7. We therefore wish to mention the following difficulties in the way of making any suggestion at this time which will be of substantial assistance to the Government in dealing with its problem at Muscle Shoals:

(*a*) Section 124 of the national defense act, of June 3, 1916, under which the Muscle Shoals dam and power plant are being constructed, contains the following clause:

"* * * The plant or plants provided for under this act shall be constructed and operated solely by the Government, and not in conjunction with any other industry or enterprise carried on by private capital * * *."

This, of course, presents a serious legal question as to the authority of the Secretary of War, the Federal Power Commission or other agencies of the Government to deal with the project without further legislation by Congress. In addition, funds must be provided and the delay and uncertaintly of action by Congress is a very serious element in any proposal.

(*b*) This company is not advised as to the extent to which the Government is disposed to consider a portion of the investment as being due to war emergency; or what portion may properly represent its power supply for nitrate purposes, in addition to which it is assumed that a portion will be charged to the improvement of navigation of the Tennessee River. These are vital considerations, inasmuch as excessive costs would burden the entire future of the power development, increase the cost of power to consumers and tend to discourage industrial enterprises which, with low power costs, should supply a market for a part of the Muscle Shoals power.

(*c*) This and other power companies engaged in public service are in duty bound promptly to find and develop sources of power at the lowest practicable cost to supply the rapidly increasing demands of the communities served. These demands are at this very moment most insistent. To fulfill its immediate requirements this company has applied to the Federal Power Commission for a license and is about to construct an important additional hydroelectric development on the Coosa River. While it is true that the power thus secured will be completely absorbed and new sources required by the time the Muscle Shoals dam could be completed, yet the difficulties above mentioned and the doubt which arises from the apparent reluctance of Congress to sanction an arrangement of cooperation, as shown by the clause of the act of 1916 above quoted, suggest that this company would scarcely be justified in depending upoon Muscle Shoals to take care of even more remote demands which are certain to arise and which must be prepared for well in advance.

8. If the above difficulties and uncertainties can in any manner be cleared up and excessive costs avoided by fair charges to war emergency, power for nitrate purposes, and improved navigation, this company is of the opinion that the development can go forward and be completed with the view of the sale and distribution of a sufficient volume of power therefrom by this company and other companies engaged in public service in the territory adjacent to this development to enable the United States to derive a reasonable return upon such part of the investment as may be properly allocated to the power feature of the project.

9. Our company, together with adjacent power companies, possesses the necessary organization for the distribution of the power to the public; and while the principal markets in the South are now served by those companies, their transmission systems would have to be supplemented by new lines and other equipment to market this power. The power systems in the southeastern States are now interconnected, and the advantage to the public of such interconnection was the subject of a careful survey by eminent engineers acting under your direction, and the subject is thoroughly discussed in a report prepared in the office of the Chief of Engineers by Col. Charles Keller and now printed as an official document, entitled "The Power Situation During the War."

We are inclosing with this letter further excerpts from that report which discuss at length the Muscle Shoals development.

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10. It will require much consideration and study to enable us to present any definite commitment, and would, furthermore, require a more definite statement as to when the power would be available and as to just what portion of the cost would be accepted as the investment in the power project, these being elements which you will appreciate are vital in determining a course in the matter so far as our ability is concerned to take the power at a price affording the United States a reasonable return.

We may add, however, that during our connection with the project, as shown by our formal proposals in response to the Government's invitation (Docs. Nos. 20 and 1262), we regarded the construction of a power dam (at reasonable costs and on commercial plans) at this locality as both a practicable and profitable undertaking; and if there is a possibility that the Government will wish to have any part of the power used in a practical way for commercial purposes, then we would like to urge now that some disposition of the matter be made as early as possible, as you can appreciate that in its present status it is a disturbing feature in the industrial situation in this section.

If, therefore, authority is conferred by Congress to conclude a contract for the use of any part of the power by power companies, we wish to assure you that we are ready to work out a mutually satisfactory arrangement looking to the completion of the dam and the disposal of such part of the power as Congress wishes to place in commercial use, desiring now, as at all times in the past, to cooperate in every way desired by the United States in working out the matter.

Yours very truly,

ALABAMA POWER CO.,
By THOS. W. MARTIN, *President.*

APPENDIX.

EXCERPTS FROM THE REPORT PREPARED IN THE OFFICE OF THE CHIEF OF ENGINEERS ENTITLED "THE POWER SITUATION DURING THE WAR."

The following is from Appendix E, entitled "Electric-Power Problems in the Southern States," pages 237–238 of that report:

"The great advantages of the interconnection and joint operation of power systems, and the economies in the building for increase in generating capacity, as herein stated, apply equally to a combination of the privately owned power companies with the Government powers now building at Muscle Shoals. The characteristics of this Government power and the gain, both to the Government and to the privately owned powers, that would result from interconnection and exchange of facilities was an important consideration in the recommendation of the Tallapoosa River project, inasmuch as the interstate combination, with other power substituted for Tallapoosa, might be quite as favorable as the Tallapoosa powers in a combination without Muscle Shoals.

"21. Under the present laws, the Government Muscle Shoals hydropower now building can not be connected to or operated in conjunction with private interests. * * *

"25. The proposed interstate-power system above described, including the proposed Tallapoosa River developments, and capable, as stated, of producing 2,100,000,000 kilowatt hours of prime power annually, if combined and operated in conjunction with a hydro plant at Muscle Shoals with 300,000 kilowatts ultimate installed capacity as proposed, would be capable of producing, in years of normal river flow, 2,800,000,000 kilowatt hours annually of prime hydropower without any steam generation."

The following is also from Appendix E, entitled "Electric-power Problems in the Southern States," pages 264 to 267, inclusive, of the report entitled "The Power Situation During the War":

"140. The proposed hydro development at Muscle Shoals authorized by the Government and now being built under the direction of the Chief of Engineers, United States Army, provides for a high dam in the Tennessee River and the installation of electric machinery for the generation of power. The river flow and other natural conditions at the site selected will permit the generation of 60,000 kilowatts during stages of low water in an extreme low year, and 300,000 kilowatts can be generated during five months in years of normal river flow.

"141. By act of Congress (39 Stat. 215) it is provided that 'the plant or plants provided for under this act shall be constructed and operated solely by the Government and not in conjunction with any other industry or enterprise carried on by private capital.' The terms of the act are such that it would be unlawful

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to interconnect this plant with central-station power systems of the Southern States and use even a portion of this power for other than Government industries.

"142. This report on the power resources of the Southern States has been prepared to point out the most economic and reliable source of power that can be utilized for serving the industries of the South with a view to securing maximum economy in generation, and the resources in water and steam power thus far considered have excluded the Muscle Shoals project by reason of the existing law prohibiting the use of this power for private purposes.

"143. The procedure is illogical and unreasonable, because in order to provide cheap power it is necessary that the best sources of power be used, whether they are hydroelectric developments using the natural flow of the rivers, or whether they are hydroelectric powers with storage reservoirs that conserve the water during high-water stages for use during low-water stages, or whether they are sources of steam power, and further it is necessary to operate these powers jointly to obtain maximum economy, reliability, and conservation of resources in fuel, labor, and materials.

"144. The best economy and reliability can not be secured by any one development, whether it is hydro power by flow of stream or by storage or steam power, but will be obtained by a suitable combination of these different sources and by the interconnection of the systems supplied by them. Muscle Shoals has been selected by the Government as a favorable location for the production of cheap power. The proposed design will furnish 100,000 kilowatts of prime power and 200,000 kilowatts of second-class power in an average year. The steam plant of 60,000 kilowatts which the Government has installed at Muscle Shoals is capable of converting a portion of the second-class power to prime power. But this combination with a steam plant at Muscle Shoals, regardless of whatever economy may result, can not be, broadly speaking, as favorable for all interests, either the Government interests or private interests, as a combination of the group of public-utility systems as described in this report. To segregate the Muscle Shoals power facilities from the other systems of the country is contrary to the policy recommended and strongly advocated; that is, of interconnecting all of the efficient going power systems and jointly operating them for maximum economy. The same principle which works for increased economy by interconnecting the public-utility power systems of the Southern States applies to a further interconnection including the Muscle Shoals plants, and in the interest of cheap and reliable power the law should be changed and the interconnection and joint operation of all of the development power should be provided for.

"145. It is important that the law should be modified and the plants perfected at an early date for the joint operation of all southern electric utilities and the Muscle Shoals power, since the recommended future construction for development of power facilities for the Southern States must depend, in a large measure, on whether or not Muscle Shoals will be available for other than Government work. For instance, if Muscle Shoals power is to constitute an important source of the generating capacity of an interconnected system for the Southern States, the logical procedure for other developments by the public-utility companies will be to build hydro plants with large storage reservoirs and steam plants, both of which will work economically in conjunction with the second-class power of Muscle Shoals, instead of developing additional flow of stream hydro power, which they might otherwise do if Muscle Shoals will not eventually be available in a few years, their own resources will not be of a nature to advantageously supplement Muscle Shoals and turn its second-class power into prime power should the Government policy be later changed. Even if a Government demand is built up for the entire use of Muscle Shoals, the Government would be handicapped in having a large amount of second-class power, which is not as valuable as prime power, and for which it would not have the most effective source of conversion of second class to prime power.

"146. It is especially desirable that the interconnection of the combined southern power system be available for the purpose of distributing the Muscle Shoals power immediately upon its completion, and at least until its own market can be obtained, and that the developments of the next 5 to 10 years be directed toward the construction of such plants as will advantageously supplement Muscle Shoals. By this is meant that by the time Muscle Shoals is completed it is perfectly practicable for the power system of the Southern States to acquire a connected load that will absorb a large part of the Muscle Shoals output and to

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have installed such plants of their own creation as will be useful to turn Muscle Shoals second-class power into prime power.

"147. It is argued that the Government steam plant can be used, when the hydro plant at Muscle Shoals is finished, to turn a large part of the second-class power into prime power. This is true; it can be used, but it is not the best plan available. There are large steam plants already built, and others will probably build before Muscle Shoals is completed, which, because of their more advantageous location for fuel, can make steam power more cheaply than the Government steam plant at Sheffield. Also, if the future load for Muscle Shoals is in a large part located at industrial centers in Alabama instead of in the Muscle Shoals-Sheffield district, the existing steam plants and prospective future steam plants will be more favorably located than the Muscle Shoals steam plant for joint operation with Muscle Shoals hydro power. This feature is important from standpoint of reliability of service and transmission cost as well as in economy of generation. In fact, if Muscle Shoals is interconnected with the other southern power systems and generally operated with them for maximum economy, the steam plants in the industrial sections of Alabama, and favorably located at the mines for cheap fuel, would be put into operation in case of low water before the Muscle Shoals steam plant would be started.

"148. If interconnection between Muscle Shoals and the big public utility power companies of the Southern States is not planned for in the near future and eventually carried out under favorable conditions, the Government development at Muscle Shoals is liable to result, not in cheapening power for the industries of the South, but rather in increasing the cost. It is a matter of common knowledge that one of the large private interests acquired the water-power site at Muscle Shoals and spent a large sum of money in preparation for a hydro development similar to the one now built by the Government, with the intention of distributing this power to the industries of Alabama, which would logically later on, through interconnections, be extended to service in Georgia and Tennessee. The Government has come into the situation and taken over this source of power and is building the plant, as provided by law, exclusively for Government use, and if this is carried out, it will result in private industries being deprived of this natural resource, which, by reason of the Government's own action in selecting this power for its use, may be regarded as a cheap source of power.

"149. We have no figures as to what the Government estimates the cost of Muscle Shoals power will be, either primary power or second-class power, since the undertaking at this place is for the joint purpose of improving navigation and for creating power, and we are not informed as to the proportionate charge that goes to these two purposes. It is, however, obvious that if a big power load is to be built up about Muscle Shoals, it must be done either by direct Government operation, or else the attraction in the way of low-priced power must be very marked to divert manufacturing from the present industrial centers and favorable locations for raw materials and transportation, to the district adjacent to Muscle Shoals, which is sparsely developed industrially. If the inducement in the way of cheap power is sufficient to overcome the natural conditions as established by the superior industrial progress in other sections, the power at Muscle Shoals must be made available at a relatively low rate, which also, without the modification of the present law, would have to be wholly for Government purposes.

"150. It therefore appears that a broad and well-founded judgment would dictate that the Muscle Shoals development should be interconnected for exchange of power with the existing power systems of the Southern States, and that this interconnection and exchange should be arranged for without delay, so that future construction, both at Muscle Shoals and elsewhere, can be directed for the production of plants which will supplement each other for economy of construction and operation."

Senator KENDRICK. It may be premature to the question at this time, but we must, as fast as possible, get to an understanding in order to reach a proper conclusion.

I want to ask in case we come to seriously or favorably look upon the proposition of the Alabama Power Co. would you be interested in a plan by which you would take the property that you ask us to transfer to you not at its cost, but its actual value, subject, of course, to all the deterioration, and then guarantee to the Government—take over the dam and complete it and guarantee to the Government the 100,000 secondary horsepower, just as you propose, at an income on the amount already invested in the dam? Would that sort of a proposition interest your company?

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To make the question plain, as I understand it you have said you would give so much for this property, take over the dam and complete it, and give in lieu of the investment or as an income on the investment already made in the dam $5,000,000, payable in installments. Now, the question in my mind is would you consider or would you be interested in a proposition under which the Government sat down with you to estimate the actual value of the property?

Mr. MARTIN. The steam-plant property, Senator?

Senator KENDRICK. The transmission line at the Gorgas plant and transfer it to you at, we will say, 80 per cent or 90 per cent of its actual value. Not the original cost, but what it would cost to replace it now.

Mr. MARTIN. We naturally would be interested in trying to solve this question. When it comes to negotiating the actual value of the plant there are various elements on which we would expect business men on both sides to differ. We, you understand, Senator, have suggested a plan by which we will undertake a very large financial obligation. That is to be considered when it comes to the question of how much we should pay for the property to the Government. All of those elements are entitled to be considered, and we are prepared to consider them, and we have felt that we have made a proposition which is fair under the conditions named. If the proposition is not acceptable, we will be prepared to negotiate.

Senator KENDRICK. As one member of the committee I just want to say, in explanation of the question, as one member of the committee I have not lost faith in the Government or the company, and I do not want to see the Government sacrifice all of this property, because I consider it absolutely unnecessary.

Mr. MARTIN. It is unnecessary.

Senator KENDRICK. If the Government went forward and completed that Wilson Dam there is not a chance in the world but that every building that it has constructed there of a permanent character would be in immediate demand for manufacturing purposes, and would bring a fair value on not the full cost, because we built them under war conditions, but certainly on the basis of their fair value.

Mr. MARTIN. There are values there that the Government can realize.

Senator KENDRICK. They have a permanent value because they are built permanently, and they are built wisely and well, and I do not believe in the whole United States there is a steam power plant like the one at the Muscle Shoals Dam.

Mr. MARTIN. It has one serious handicap, Senator; it is located over 100 miles from the coal field.

Senator KENDRICK. Yes, but we are going to overcome that with water transportation.

Mr. MARTIN. That is one of the serious questions.

Senator KENDRICK. That will eliminate a large part of that difficulty.

Mr. MARTIN. Of course in any case in a steam plant located away from the coal find it always has the handicap of freight rates, or rates, at any rate, to get coal there.

Senator KENDRICK. Yes. I want to ask you a question about that, Mr. Martin. These are questions I am asking myself in connection with the solution of this problem.

If you were locating the steam plant to-day and you had open navigation from the coal mines to that plant, would it not in your judgment form a more economical unit to operate to have the steam plant right there by your power plant, if you had cheap transportation for coal?

Mr. MARTIN. No. Senator, if we had to locate a steam plant there——

Senator KENDRICK. Does it not cost like the dickens to maintain a power line?

Mr. MARTIN. No, sir. It costs, yes, but——

Senator KENDRICK. I should think it would be much like maintaining the cost of any other kind of a transportation line.

Mr. MARTIN. You visited the situation recently, didn't you, Senator, with the committee? Didn't you go South with the committee?

Senator KENDRICK. Yes. I was along.

Mr. MARTIN. You see the advantage of the steam plant at Warrior, as that plant is right at the mouth of the mine.

Senator KENDRICK. Yes.

Mr. MARTIN. You see the great advantages there, with coal operations that can be speeded up or retarded to meet the needs of the plant, delivering coal

from the mouth of the mine to the steam plant without any transportation charges.

Senator KENDRICK. Yes; that is all true, but here is your investment in the transmission line. That is the first thing. Your maintenance of the transmission line. Then your increased lost motion and cost of administration because your business is scattered.

Mr. MARTIN. If you are going to locate large steam plants to serve any large area it is better to put them in the coal fields rather than to depend upon transporting coal by freight.

Senator KENDRICK. That is a question I wanted to develop.

The CHAIRMAN. Mr. Martin, this is a question that I also asked Colonel Barden. Maybe you know. If you do I wish you would tell us. Why did the Government build the steam plant right there by nitrate plant No. 2 instead of building it over there at Warrior River or some other place at the mouth of a coal mine? There are coal mines everywhere along there. You could build one any place.

Mr. MARTIN. Of course, I should qualify my statement to you, Senator. The problem of the war was the one that settled the location of the steam plant at Sheffield, because at that time it was deemed wise to have a source of power immediately under the control of that plant rather than at the end of a transmission line. That was the reason that caused it to be located at Sheffield, as I understand. Aside from that, it was not located on a commercial basis.

The CHAIRMAN. Exactly; but the primary object of the whole thing there when we began was as a war proposition entirely.

Mr. MARTIN. Yes, sir.

The CHAIRMAN. And I suppose if the Government retains it it will be with that idea in the future, that we may have another war. The idea is that in case of war we should have a plant that is best suited for all conditions?

Mr. MARTIN. Yes, sir.

The CHAIRMAN. While it would be a little more expensive, the power plant located 100 miles away from the machinery would necessitate the guarding of a transmission line in time of war.

Mr. MARTIN. That was the theory.

The CHAIRMAN. And the whole thing could be put out of business by some man cutting the wire, could it not?

Mr. MARTIN. Yes. Of course, we did not have any trouble. We operated the line seven months during the war.

The CHAIRMAN. Yes; that is true.

Mr. MARTIN. But that led to the location, principally, of the plant where it was located.

Senator KENDRICK. I have a question, Mr. Martin, that I wanted to ask. Have you any idea as to the approximate distance between the power plant and the nearest dependable supply of coal?

Mr. MARTIN. The Muscle Shoals steam power plant?

Senator KENDRICK. Yes. We have heard a good deal about coal mines in every direction there, and my idea was to ascertain how near coal is that can be reached by water transportation.

Mr. MARTIN. The nearest coal is in the Warrior coal fields, in the locality of Cordova, where you took the boat going down the river.

The CHAIRMAN. That coal can not be transported to Muscle Shoals except by railroad?

Mr. MARTIN. By railroad.

The CHAIRMAN. The Senator's question is where is the nearest coal on the Tennessee River?

Mr. MARTIN. I can not answer.

The CHAIRMAN. Is not that your question?

Senator KENDRICK. Yes; or by water; whether it be on the Tennessee or a tributary of the Tennessee.

The CHAIRMAN. By water means the Tennessee River.

Senator KENDRICK. Yes.

The CHAIRMAN. In other words, how far is it from Muscle Shoals to the coal fields?

Mr. MARTIN. I can not answer that question. While we were operating the steam plant there we were getting the coal in that district in the neighborhood of Cordova.

Senator KENDRICK. That would have a bearing on the cost of fuel, whether you could secure water navigation?

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Mr. MARTIN. Undoubtedly water transportation will have a serious effect upon the value of that plant.

I want to mention one other question. The whole matter of this Muscle Shoals received a still further review by Government engineers at the conclusion of the war in a volume entitled "The Power Situation During the War," which was prepared by Gen. Charles Keller, Corps of Engineers, and published by authority of the Secretary of War in 1920, excerpts of which I would like to hand to the reporter for the record.

In the course of that report it was again recommended by the engineers that this Muscle Shoals development should be interconnected with the other power systems of the South. The concluding paragraph reads as follows:

"It therefore appears that a broad and well-founded judgment would dictate that the Muscle Shoals development should be interconnected for exchange of power with the exist ng power systems of the Southern States, and that this interconnection and exchange should be arranged for without delay, so that future construction, both at Muscle Shoals and elsewhere, can be directed for the production of plants which will supplement each other for economy of construction and operation."

(The excerpts from the report referred to are as follows:)

ELECTRIC-POWER PROBLEMS IN THE SOUTHERN STATES.

Preface.—1. The following report has been prepared to summarize the power situation in the States of Alabama, Georgia, Tennessee, North Carolina, and South Carolina (hereinafter referred to as the Southern States), as developed by the investigations of the Army engineers assigned to service in the power section of the War Industries Board. It completes the information and conclusions reached in directing power service for war industries prior to the armistice on November 11, 1918, during which time they were informed concerning the power resources and limitations in this district, and contains recommendations for increasing the annual power supply for industries in these States to meet anticipated future requirements to an aggregate increase of 1,000,000,000 kilowatt hours within the next five to seven years.

This report covers the central station electric power generating and distributing systems and gives no details of the generation by isolated plants not connected to central station systems, concerning which there is no authoritative summary as to aggregate amounts of power or costs. The report recognizes that further centralization of the power supply in these States, with the discontinuance of isolated plants, is the economic and practical end to which power service should tend. This is now, and has been for some years, the trend of the times, and the power diverted from isolated plants to central systems will constitute a considerable portion of the estimated increase of central station service contemplated for the future as discussed in this report.

It is recognized that the resources in water, power, and fuel differ in the several States, that the demand for power in the various States is diversified as to nature and amount, and that the most economical and reliable service will be attained by developing the different resources according to their relative value and interconnecting these to make a unified and balanced system, utilizing in each instance the most available source of power without regard to existing individual ownership or State lines.

4. In preparing this report and the herein contained recommendations it has been borne in mind that power delivered to points approximately central to the industrial power-consuming sections is of greater value and economic importance than power located remote from the industrial centers, which power requires for its utilization either long-distance transmission lines or the creation of new industries to be built up around the centers of cheap power. Such new industries would be mostly of an electrochemical or metallurgical nature and would afford only a relatively small return per unit of power used compared with the diversified and established industrial operations in the Southern States.

5. Central-station systems have met the war needs in a superior way and have strikingly demonstrated the advantages of centralized service as compared with isolated-plant service. In cases of increased power requirements for war production the central systems have—far more rapidly than isolated plants, and with less demand on labor and material resources—increased their capacity to meet growing needs. Also they were better able to deliver their output to those particular points where the requirements of the war industries neces-

sitated, since, for any additions to power supply for war needs in specific sections, they could draw upon the central system even when necessary by the reduction of power supply to less essential users. This could not be done in the case of isolated plants equipped to serve only the specific factories and establishments for which they were constructed.

6. This report will consider only the question of power generation by interconnected power systems in the States above mentioned and will not concern itself with the matter of distribution of customers beyond the main generating plants, substations, and the center connecting trunk lines. The problem herein discussed has to do with steam and hydroelectric generation and the essential interconnection of generating stations to secure minimum capital cost and operating costs for power on main trunk-line systems connecting the generating plants and industrial centers. It is to be noted that a very large additional expenditure, not included in this discussion, is necessary to distribute power from these generating plants and trunk lines to power consumers, and it is observed that frequently the cost of distribution from the trunk lines to the consumers exceeds the cost of generation and the trunk-line expenses.

7. Uncertainty exists concerning the future cost of labor and material for engineering works necessary for developing power. For the purpose of comparing the cost of these developments in the different States the cost has been figured as near as may be upon the pre-war cost, plus 40 per cent. This is much less than the cost of such works during the past year and at the present time, but for comparative purposes, and as the result of careful examination, is adopted as a reasonable estimate for future work covering a period of five years.

8. The report first describes the power systems of the Southern States as they existed prior to the armistice, and the conditions under which service was rendered during the war; second, there are mentioned certain additions and improvements which are now being made, contemplated, or recommended for better economy and reliability of supply and service to the existing industries; third, recommendations are made for additional power developments to meet the future demand of 1,000,000,000 kilowatt hours, more or less, over the present demands, and also for complete interconnection of the existing power systems and future developments; and last, there is included a discussion of the power systems, of the advisability of joining the Muscle Shoals power with that of the combined system, and of the effect of interest charges on the cost of power.

Summary.—9. This report states briefly the power requirements of the Southern States and the conditions under which this power is now supplied, and makes recommendations for improving and increasing power generation to provide for public and private needs. The requirements are now supplied partly by central station electric systems, which serve diversified industries, and partly by isolated steam or water power plants built and operated individually for specific factory or other needs. In the interest of economy, reliability, and conservation isolated plant generation should be discontinued and central power substituted. Industrial development in these States and the conservation of isolated plant service and improvement of power supply will require within the next five to seven years, according to approximate estimates, 1,000,000,000 kilowatt hours increase in annual production, of which 300,000,000 kilowatt hours is allocated to the Carolinas and 700,000,000 kilowatt hours to the States of Tennessee, Alabama, and Georgia.

10. The investigation made for the purpose of this report does not include a conclusive investigation of the power resources in the Carolinas. With the data at hand we are unable to indicate that the Carolinas have any natural resources in hydropower or other sources that are suitable for the creation of this new power on a basis that would compare favorably with the production by a proposed tri-State interconnected system as described for Alabama, Georgia, and Tennessee, and it appears probable that a large part of the additional power required in the Carolinas could be more economically derived from the interconnected system of these three States. If the anticipated increase for the Carolinas is derived from these three States, the developments recommended for the latter will have a sufficient excess generating capacity to supply the Carolina requirements.

11. There are certain large hydrodevelopments that have been constructed and others that are projected in Tennessee and North Carolina by private interests for the purpose of manufacturing aluminum. These developments and projects have not been considered in this report as part of the proposed

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interstate power system for the reason that the resources and requirements of the private aluminum manufacturing interests are not set forth with sufficient assurance regarding future conditions to permit of establishing a measure of the value of their resources in combination with interstate transmission lines. Unquestionably, if an interstate combination is built up as described and recommended in this report, benefit will accrue both to the aluminum manufacturing concern and to the interstate systems if interchange of power is arranged for.

12. In estimating the additional power service that can advantageously be rendered by the central station systems account has been taken of the established central station business and the reasonable expected increase in going industries. Provision has not been made in these recommendations for extraordinary additions to the power service to provide for a large, new electromechanical undertaking or for railroad electrification. One billion kilowatt-hours' increase, as described, is the foreseen requirements without these new industries of electromechanical and railroad electrification.

13. The major central station systems at present in operation in the States of Alabama, Georiga, and Tennessee have an aggregate prime generating capacity estimated at 1,230,000,000 kilowatt-hours annually, and it is estimated that the central station output should be increased by 700,000,000 kilowatt-hours annually to provide for the conversion to central station service of power now being generated by isolated plants and for normal industrial growth anticipated within the next five to seven years.

14. As the best means of increasing the aggregate capacity of the central power systems of the three States and to improve economy and reliability it is recommended that the major power systems now in these States be effectively interconnected by transmission lines and the best available resources for hydro and steam power be developed to increase the interstate combined system.

15. An examination of the central power systems for 1919 conditions shows that these systems, when operated individually, have an aggregate generating capacity capable, under commercial conditions, of producing 1,230,000,000 kilowatt-hours of prime power annually, of which 13 per cent, or 163,000,000 kilowatt-hours, in seasons of normal river flow would have to be produced by steam plants, requiring a consumption of 190,000 tons of coal annually. By effectively interconnecting these systems and operating them for the best joint economy the capacity of the combined systems would be increased to 1,370,000,000 kilowatt-hours annually, requiring in years of normal river flow the production of 132,000,000 kilowatt-hours by steam, with a consumption of 140,000 tons of coal. An increase of 140,000,000 kilowatt-hours in the generating capacity is effected by complete interconnection and joint operation, as above, which in itself is an important reason for interconnection.

16. In building for increased power production needed to convert isolated plant service to central station operation and to provide for industrial growth, the proposed interstate interconnected power system affords a marked advantage over the present plan of independent disconnected or inadequately interconnected systems, particularly as the interconnected systems would permit the use of the most economical sources of power within the area of the proposed interstate system, regardless of the relative location of these sources to localized market centers.

17. Contemplating the adoption of this plan, and in order to provide increased power facilities for the production of 700,000,000 kilowatt hours annually (the estimated requirements for isolated plant conversion and industrial growth within the next five to seven years), it is recommended that the hydroelectric plants be built on the Tallapoosa River, Ala., near Cherokee Bluff, together with a large storage reservoir. The present power systems combined with the proposed Tallapoosa plants would have a generating capacity of 2,100,000,000 kilowatt hours annually, which is an increase of 730,000,000 kilowatt hours over the capacity of the present systems if interconnected and jointly operated.

18. Building for increased power production in the three States under consideration should not, and will not, cease with the installation of 700,000,000 kilowatt hours increase in annual capacity. It is anticipated that with this increase provided for during the next five to seven years still further increased capacity should be undertaken for growth following the five-year period; and the recommendation of Tallapoosa is made with a view to later additions to the generating capacity of an interstate power system for Alabama, Georgia,

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and Tennessee, and possibly the Carolinas. Developments which compare favorably with the Tallapoosa project have been examined and considered:

(*a*) On the Chattahooche River, at Bartletts Ferry, in western Georgia, for increasing the capacity of the interstate system by 170,000,000 kilowatt hours annually.

(*b*) Two developments, referred to as Tugaloo and Mathis, on the Tugaloo River in northeastern Georgia, for increasing the capacity of the system by 240,000,000 kilowatt hours annually.

19. A large number of other developments, including steam plants at coal-mine centers, were examined and compared, but considered less favorable than those mentioned above as components of the power system composed of the present central-station systems adequately interconnected.

20. The great advantages of interconnection and joint operation of power systems, and the economies in building for increase in generating capacity, as herein stated, apply equally to a combination of the privately owned power companies with the Government power now building at Muscle Shoals. The characteristics of this Government-owned power and the gain both to the Government power and to the privately owned powers that would result from interconnection and exchange of facilities was an important consideration in the recommendation of the Tallapoosa River project, inasmuch as the interstate combination, with other power substituted for Tallapoosa, might be quite as favorable as the Tallapoosa powers in a combination without Muscle Shoals.

21. Under the present laws, the Government Muscle Shoals hydropower now building can not be connected to or operated in conjunction with private interests.

22. The Government hydropower at Muscle Shoals will be on a variable river, with opportunity for the development of a vast amount of second-class, or nine-months power, and a relatively small proportion of twelve months, or primary power. A Government-owned steam plant being built at Muscle Shoals will be capable of converting a portion of the second-class power into prime power, but it can not do so as economically as the combination with the proposed interstate power system, because if steam-plant auxiliary power is to be used with the Muscle Shoals power, other steam plants already constructed are more favorably situated than the Government steam plant for furnishing the bulk of this supplementary steam power.

23. Still further, if the Government needs do not require the entire output of the Muscle Shoals plants, it would be a criminal waste to deprive the industries of Alabama and adjacent States of this supply of power. We want to emphasize that an interconnected power system, as herein recommended, is the best possible vehicle for taking over such part of Muscle Shoals power as the Government may not require for its own uses, and delivering it to the Southern States industries, and that to make provision for doing this efficiently such use of the surplus power should be arranged for at a very early date, and considered in connection with private-plant developments to the end that these developments may be of a character that will advantageously supplement Muscle Shoals.

24. It is recognized that the resources for cheap power in the Southern States are one of their most valuable assets industrially and Muscle Shoals hydropower has long been looked upon as a favorable project, particularly in combination with Tennessee River improvements for navigation, and prior to the war a private corporation even went so far as to spend some hundreds of thousands of dollars in securing property rights and exploring foundations and making designs. It appears that with an exchange of power between the Government interests and private power systems, maximum economy will result to both interests, whereas, if the present law is enforced, the Government will lose the economic advantage of interchanging power with existing privately owned systems and the southern industries will be deprived of the benefit of Muscle Shoals power.

25. The proposed interstate power system above described including the proposed Tallapoosa River developments, and capable, as stated, of producing 2,100,000,000 kilowatt hours of prime power annually, if combined and operated in conjunction with a hydroplant at Muscle Shoals with 300,000 kilowatts ultimately installed capacity as proposed, would be capable of producing, in years of normal river flow, 2,880,000,000 kilowatt hours annually of prime hydropower without any steam generation.

Mr. MARTIN. That is a full treatment and the most recent printed treatment by the department.

On June 18 last we received another letter from General Beach, and replied under date of July 14, 1921, with regard to the question of power market, which

I would like to file for the record. He inquires the amount of power we would take from Muscle Shoals, and when we could take it. That is on the theory of the Government giving us certain advance notice of the actual date when power would be delivered. We advised General Beach that we were in the midst, then, of a power development which, however, would be absorbed completely by the market when it was completed, and that by the time the Muscle Shoals power could be completed further large demands for power in territories served by our company and immediately adjacent territory must be met, and while we did not go into details as to what the market was in that letter, I am prepared, if the committee wishes to hear it, to go fully into the question of the available power market now and as it will be by the time the Muscle Shoals development can be completed.

The CHAIRMAN. All right. Go ahead. I think that ought to be in the record whether we are directly interested now or not, because that is one of the things that will have to be considered, no matter what is done.

Mr. MARTIN. First, I would like to have these letters go into the record.

(The letters referred to are as follows:)

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, June 18, 1921.

Mr. T. W. MARTIN,
President Alabama Power Co., Birmingham, Ala.

DEAR SIR: I would like to inquire what power the Alabama Power Co. would desire or be willing to take from Muscle Shoals two years from this date, and also three years from this date, if one year's advance notice of actual date at which power could be delivered could be given and a satisfactory price is guaranteed?

Very truly yours,

LANSING H. BEACH,
Major General, Chief of Engineers.

ALABAMA POWER CO.,
Birmingham, Ala., July 14, 1921.

Maj. Gen. LANSING H. BEACH,
Chief of Engineers, United States Army, Washington, D. C.

DEAR SIR: We wish to acknowledge receipt of your letter of the 18th ultimo, inquiring what power this company would desire or be willing to take from Muscle Shoals two years from that date, and also three years from that date, if one year's advance notice of actual date power could be delivered, could be given, and a satisfactory price guaranteed.

We wrote you under date of May 28 last regarding certain aspects of this problem, to which we beg to refer in connection with our answer to your letter. As therein stated, we have insistent demands for power; that to fill its immediate requirements this company has applied to the Federal Power Commission for a license to construct an important additional hydroelectric development on the Coosa River and added:

"While it is true that the power thus secured will be completely absorbed and new sources required by the time the Muscle Shoals Dam could be completed, yet the difficulties above mentioned and the doubt which arises from the apparent reluctance of Congress to sanction an arrangement of cooperation, as shown by the clause of the act of 1916 above quoted, suggest that this company would scarcely be justified in depending upon Muscle Shoals to take care of even more remote demands which are certain to arise and which must be prepared for well in advance."

We concluded our letter in this language:

"If, therefore, authority is conferred by Congress to conclude a contract for the use of any part of the power by power companies, we wish to assure you that we are ready to work out a mutually satisfactory arrangement looking to the completion of the dam and the disposal of such part of the power as Congress wishes to place in commercial use; desiring now, as at all times in the past, to cooperate in every way desired by the United States in working out the matter."

Since that letter was forwarded to you, the Federal Power Commission has issued to this company a license to construct the Coosa development. We are planning to install 60,000 horsepower, and preliminary construction is now be-

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ginning. It is our purpose to prosecute the work with all diligence with the view of having power available therefrom in the spring of 1923. While the initial installation as now planned is 60,000 horsepower, the ultimate installation will be 120,000 horsepower. In going forward with this development we considered that we were in duty bound to proceed because it did not seem at all possible that the Muscle Shoals hydro development could produce any power during 1923 or 1924. Our power demands are at present in excess of our water-power capacity, but the power which will result from the new Coosa development will fulfill our immediate requirements, i. e., will enable us in 1923 to greatly reduce our steam running and we will thus be enabled to meet the public demands during 1923, and for the most part in 1924, with the output of our hydro plants.

However, we wish to say that study of the power markets in the territory served by our company convinces us that the demands for power will require further sources which should be available during 1926 at the latest.

We must make our plans for several years in advance of actual power needs and longer notice than one year in advance of actual date at which the Muscle Shoals power could be delivered would be necessary for this company to commit itself for the taking of definite amounts of power; and unless a commitment can be made not later than March, 1922, by the United States Government for delivery of definite amounts of power, we will find it necessary to proceed with another hydro development in Alabama to meet our requirements. We will be glad meanwhile to discuss the subject with you in a definite way if desired.

Waiting for your further suggestions, we are,

Yours very truly,

ALABAMA POWER CO.,
By THOMAS W. MARTIN,
President.

Mr. MARTIN. Naturally, Mr. Chairman, if we were to assume, as we propose, an obligation to complete the Wilson Dam, there must be a market which we will find for the power, and we have gone into the question at great length.

The CHAIRMAN. You have, with a view of making this proposal, of course, studied the question. The committee would be very glad to have the result of your investigation.

Mr. MARTIN. This document prepared by the Government engineers discusses that question and what could be done immediately.

Going to our statement which we filed in the House committee hearings, it is our view that in Alabama and contiguous territory there will be a market by January 1, 1926, for additional power, part of which can be supplied from Muscle Shoals, approximately 580,000 horsepower. Now, I will give you the details of that. I will file this statement in that connection.

(The statement referred to is as follows:)

"(1) The present power and lighting load of Alabama Power Co. can be considered as 135,000 horsepower; (2) the maximum load established in December, 1921, due to urgent needs for power in Georgia and Carolina, was 160,000 horsepower; (3) with a return to normal business conditions in coal, iron, and textile industries in 1922, the power and lighting load, exclusive of requirements in Georgia and Carolina, will be 160,000 horsepower; (4) assuming 10 per cent per annum as a measure of natural growth of load, due to increased use by present customers plus new industries that will be attracted into the State by low-priced power, the load in 1926 will be 210,000 horsepower; (5) there is an available power load in territory adjacent to present transmission lines of Alabama Power Co., exclusive of railway electrification, of 160,000 horsepower; (6) there is a power load available to Alabama Power Co. by extension of lines to Memphis, New Orleans, Mobile, Meridian, etc., of 200,000 horsepower; (7) the Tennessee Power Co., the Georgia Railway & Power Co., the Columbus Power Co., the Central Georgia Power Co., in order to supplement existing plants, will absorb 70,000 horsepower; (8) railway electrification in Alabama alone offers a potential market for 240,000 horsepower; (9) the total load in 1926, inclusive of present load plus prospective load, may reasonably be 880,000 horsepower; (10) Alabama Power Co. present generating capacity, 190,000 horsepower; (11) additional generating capacity from Muscle Shoals steam plant, 80,000 horsepower; (12) additional generating capacity from Mitchell Dam, 110,000 horsepower; (13) total generating capacity available

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under present program, without Muscle Shoals, in 1926, will be 370,000 horsepower; and (14) deficit to be supplied by Muscle Shoals, 580,000 horsepower."

Mr. MARTIN. The present power and lighting load of Alabama Power Co. can be considered at 135,000 horsepower.

The maximum load established in December, 1921, due to urgent needs for power in Georgia and Carolina, was 160,000 horsepower.

We have a connected load to-day of 370,000 horsepower. With a return to normal business conditions——

Senator KENDRICK (interposing). What do you mean by connected load?

Mr. MARTIN. That is customers on the line whose machinery and power using equipment amounts to a total of about 370,000 horsepower, but that does not mean that all of that load is using power at once. There is a diversity factor that enters into it and the result of that is that approximately one-half or a little more of that load calls on us at one time. That would establish what we call the peak load.

With a return to normal business conditions in the present year we will have on our system a peak load of 160,000 horsepower, according to the business which is now in sight. We assume that business will increase 10 per cent, that the normal load of our consumers will increase 10 per cent annually——

The CHAIRMAN (interposing). Without any new customers?

Mr. MARTIN. Yes, sir. That is the history of the business. A manufacturing company, satisfied with the service, will ordinarily increase its consumption 10 per cent.

Assuming 10 per cent per annum increase in the load, by increased consumption of our present customers, and some new industries which normally come into the territory, his load will approximate 210,000 horsepower by 1926.

Senator KENDRICK. Is not your estimate 320,000 horsepower in 1926?

Mr. MARTIN. Yes, sir.

Senator KENDRICK. Is not that rather conservative?

Mr. MARTIN. Yes. We excluded certain territory, certain loads which we have not taken into consideration; but the details of this sheet, which I will hand to the reporter, show step by step the loads, as I have stated, the territory embracing Memphis, New Orleans, Mobile, and Meridian, and the communities within transmission distance of Muscle Shoals, as you can see from the map on the wall. Those circles are placed at a radius of 50 miles, beginning with Muscle Shoals. You will notice New Orleans is about 450 miles, but if a system such as the Alabama Power Co. were serving New Orleans, it would run a line from the development in and around Montgomery and supplement the load from Muscle Shoals.

Senator KENDRICK. Would you expect to go as far away as New Orleans?

Mr. MARTIN. It is quite practicable. And Mobile offers a very substantial market. Many of the towns and cities in Mississippi, as you will see, are within easy transmission distance.

Senator HEFLIN. What is the distance, direct, of your power line from Montgomery to Muscle Shoals?

Mr. MARTIN. That is 175 miles.

I will not worry you with the details of this power load, gentlemen. I have placed it in the record.

Now, the committee requested us yesterday to give them some figures as to the estimated cost of completing Wilson Dam.

Our proposal contemplates, as we stated yesterday, that we will take up the construction of Wilson Dam in its present state and complete it, subject, as I stated, to the inspection of the engineers of the United States, and under the water power act, just as we are now doing at the Mitchell Dam on the Coosa River, of course, following standard lines of engineering practice. We estimate that for the 18 units proposed to be completed the cost would be about $26,354,000. For eight units to be installed at the time of completion the cost, according to our estimate, is $18,854,000.

To our figures, of course, we add whatever amount we pay the Government for the steam plant and whatever we expend for lines.

Senator KENDRICK. $26,354,000 does not include all the units? That is eight units?

Mr. MARTIN. No; that is the 18 units.

Senator KENDRICK. Then the $18,000,000 includes what?

Mr. MARTIN. Eight units.

Senator KENDRICK. The completion of the dam and eight units?

Mr. MARTIN. Yes, sir.

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The CHAIRMAN. That means how much horsepower? What is the capacity of one of those units? It is 30,000 horsepower per unit, is it not?

Mr. MARTIN. Yes, sir.

The CHAIRMAN. The Government plan is for the installation of eight units only to begin with, is it not? That is as I remember Colonel Barden's testimony.

Major BURNS. I think he figures only on four units.

Mr. MARTIN. He figures eight units, as I recall.

The CHAIRMAN. The four units, Major, the Government has already bought the machinery for, as I understand.

Major BURNS. My recollection is that he said four units. To supply power to complete the nitrate plant requires the product of about four units.

The CHAIRMAN. About 120,000 horsepower.

Senator KENDRICK. Do you recall, Major Burns, what estimate of cost Colonel Barden put on the completion of the dam and those four units?

Mr. MARTIN. $23,177,000 for eight units.

Senator KENDRICK. About $5,000,000 in excess of that you place it?

Mr. MARTIN. Yes, sir.

The CHAIRMAN. He counted on eight units, although they have only four units purchased. I think he figured, when it is completed, on putting in eight units.

Mr. MARTIN. That completes what I wish to say on direct, I believe.

The CHAIRMAN. Mr. Martin, there are a great many questions I want to ask you; but, as I understand it, you have somebody else who will take up the Gorgas plant, and you do not care to discuss it?

Mr. MARTIN. I will do it myself, though Mr. Dent should be present, but I am at your service.

The CHAIRMAN. If you want him present we will not go into it now. Will he be here to-morrow?

Mr. MARTIN. No, sir.

The CHAIRMAN. As I understood you, it was your intention, after you had explained your bid, to wait until some time later in the proceedings, when Mr. Dent will go on and take up the legal explanation of the proposition. Is that right?

Mr. MARTIN. There was only this point, Senator——

The CHAIRMAN (interposing). The committee is perfectly willing for you to take that up now and go right on, or we will go on with the next proposition.

Senator HEFLIN. Mr. Chairman, I spoke to you about Mr. Dent taking up the legal phases of the situation. He represented the Alabama Power Co. with reference to the Gorgas plant, and he proposes to argue the legal phases of it to the committee. Muscle Shoals and those projects were not connected with what he was to appear before the committee about. Is not that right, Mr. Martin?

Mr. MARTIN. Yes, sir. So far as the Gorgas plant is concerned, there is another proposal that undertakes to have the Government turn that over. Until that proposal is taken up, we did not intend to discuss that situation, but we are at your disposal.

The CHAIRMAN. You mean that in in your contract that you have with the Governemnt that is provided for?

Mr. MARTIN. Yes, sir; and until that issue is presented it is Mr. Dent's idea we would not be called upon, but we are subject to your wish. If you wish us to go ahead with that now, we are ready to do so.

The CHAIRMAN. I do not want to interfere with your plans.

Senator HEFLIN. My understanding about that is that the Alabama Power Co. claims that under contracts it would have the right to bid first, would have the first opportunity to take over the Government's interest in the Gorgas plant. The Judge Advocate General of the Army has rendered an opinion that that contract is not binding. Is that right, Major Burns?

Major BURNS. That is correct.

Senator HEFLIN. And that presents the issue that Mr. Dent will want to argue.

The CHAIRMAN. Of course there will be other parties, I assume, or other bidders will be interested in that legal phase of the proposition. It will not only be the Alabama Power Co., because where a bid is made that includes the Gorgas plant it means that it brings on a contention right away with the Alabama Power Co. because they are claiming, as I understand it, under a

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contract made with the Government when the Government made the improvement that they are entitled to buy the Government's interest in it.

Mr. MARTIN. Which we think is a valid, legal, subsisting contract, the Judge Advocate to the contrary notwithstanding.

The CHAIRMAN. For instance, the Ford offer includes Gorgas. If the Ford offer is accepted, the Government must take all of Gorgas. It must take what the Alabama Power Co. has. I suppose his lawyer would argue that we have a right to do that, and the Alabama Power Co.'s attorneys will argue the other way. So in any other man's offer who includes Gorgas in his proposition.

Senator HEFLIN. Mr. Dent said he would come back when the committee wanted him to appear.

Senator KENDRICK. With this difference, Mr. Chairman, I think, that Ford's offer is that that is one of the conditions named in his proposed deal with the Government, and he cites this opinion of the Judge Advocate General as authority, while the Alabama Power Co. has it written into a contract, has this provision written into a contract. That is a real difference.

The CHAIRMAN. That is a contract that Mr. Ford would claim, I assume, is nul and void, in accordance with the decision rendered by the legal officer of the Army.

Mr. MARTIN. The legal officer probably made his decision without full knowledge of the facts.

The CHAIRMAN. That is one of the disputed questions that will be before the committee. I am not expressing any opinion on it whatever, because I want to keep my mind open until the lawyers have argued it, if I can. There are two questions involved in it. The first is the legal question: Can we avoid the contract if we want to, and, second, assuming that we could do that, do we want to? As I understand it, both those questions will be presented for the committee to decide. If we decide first that we could not avoid it if we wanted to, that the Government is bound by it as a matter of law, that is ended, and there is no use in considering any proposal in which that is involved.

Mr. MARTIN. I might mention, Mr. Chairman, that the question is before the Department of Justice.

The CHAIRMAN. It is pending before the Department of Justice now?

Mr. MARTIN. Yes, sir.

The CHAIRMAN. I suppose the committee, if it decides to take up and pass on these offers, and leases this property to somebody, will summon before it the Attorney General or his assistants, and perhaps submit it to other lawyers and get their opinions, if they have any doubt as to what the law is. It may be that the committee will decide that we do not want to accept any offer. If we do, we do not care what the legal question involved is; we do not need to go into it.

I have introduced a bill here providing for the Government operation of this whole thing, by a governmental corporation. I would like to ask if you have examined that bill?

Mr. MARTIN. Yes, Mr. Chairman.

The CHAIRMAN. Do you care to express any opinion on it or to say anything about it?

Mr. MARTIN. Does it involve the Government furnishing the funds, all the money, and also distributing the power?

The CHAIRMAN. Well, it provides a governmental corporation. First, that the Government shall complete the dam at its own expense, and that it shall be turned over to a governmental corporation, which shall have complete control of the power, and that they shall proceed to operate these plants and make fertilizer, if they can, and sell the power if they do not want it all, to anybody who wants to buy it.

Mr. MARTIN. So far as the Alabama Power Co. is concerned, we will be very glad to cooperate in any plan that the Government works out. We feel that a greater volume of power would be available by the development of other watersheds, and other agencies, possibly, might want to take the power. We will be glad to cooperate in any Government plan that is worked out.

The CHAIRMAN. Do you care to discuss the Ford proposition?

Mr. MARTIN. Well, Mr. Chairman, I——

The CHAIRMAN. We will ask Mr. Ford to discuss yours. If you want to discuss Mr. Engstrom's proposition, I think it is perfectly proper for you to do so.

Mr. MARTIN. The answer that I would make is embodied in our statement published in the State of Alabama, on this whole question, in which we ex-

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plain the differences between and the advantages of our proposal over that of Mr. Ford.

The CHAIRMAN. That is one of the things the committee is going to consider—if it is going to let this out to anybody. We want to get the best advantage we can to the Government without doing any injury to the people anywhere. We are not requiring you to do that and not requiring anybody else, but it is going to be open, and you can discuss anybody's proposition that is going to be before us, and so they can discuss yours.

Mr. MARTIN. Leaving aside the whole question of whether the bid is before the committee——

The CHAIRMAN. There is, of course, only one bid before the committee, but, of course, we believe there are going to be several other bids, and you know what they are, and you can discuss any of them now if you want to.

Mr. MARTIN. The whole question, as it seems to us, is whether the power at Muscle Shoals is to be devoted to private or public use. In our plan we propose to devote it to public use. Under the plan which is proposed by the Ford offer it will be devoted to private use. The testimony before the House committee was to the effect that there would be no power for public distribution under the plan proposed by Mr. Ford. That plan was in and of itself a contract which in its terms does not embrace the terms of the Federal water power act, hence those restrictions and conditions which the licenses under that act subject themselves to are not part of the terms and conditions under which Mr. Ford would develop the power. The license period is fixed at 50 years under the Federal water power act, with the right of the Government to recapture at the end on the basis of the investment.

There is the further question of the regulation of rates, service, and security issues; and, further, Mr. Chairman, the duty of that licensee to pay to the Government excess profits earned over the return stipulated in the license. That is one of the restrictions and obligations of the licensee under that act which is one of the very important terms that is not found in the proposal of Mr. Ford.

The CHAIRMAN. We will have to adjourn until 10.30 to-morrow morning.

(Whereupon, at 12.15 o'clock p. m. the hearing was adjourned to 10.30 o'clock a. m., Wednesday, April 19, 1922.)

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MUSCLE SHOALS.

WEDNESDAY, APRIL 19, 1922.

UNITED STATES SENATE,
COMMITTEE ON AGRICULTURE AND FORESTRY,
Washington, D. C.

The committee met, pursuant to adjournment, at 10.30 o'clock a. m., in Room 224 Senate Office Building, Senator George W. Norris (chairman) presiding.

Present: Senators Norris, Capper, Ladd, Norbeck, Harrison, Heflin, and Caraway.

The CHAIRMAN. The committee will come to order. Mr. Martin may proceed.

STATEMENT OF MR. THOMAS H. MARTIN—Resumed.

Mr. MARTIN. All of the licensees under the Federal water power act are now subject to the restrictions and obligations to which I have referred, and I would like to insert at this point in my statement a brief memorandum with regard to some of the principal features of the Federal water power act which we feel are important to consider in the public interest in the consideration of this question.

The CHAIRMAN. Suppose you read it. The committee would like to hear it.

Mr. MARTIN. I call attention, Mr. Chairman, to certain provisions of the Federal water power law, safeguarding the public's interests, preserved by the offer of the Alabama Power Co. for the Muscle Shoals project:

"1. As a part and condition of any license issued to develop water power the project adopted, its plans, and specifications must be such in the judgment of the Power Commission that are 'best adapted to a comprehensive scheme of improvement and utilization for the purposes of navigation, of water power development, and of other beneficial public uses.' (Sec. 10 (a).)

"2. Excess profits of the licensee from the water must be paid to the United States, whether they are profits of a public utility or a private user. (Reg. 18, Sec. 106.)

"3. The franchise is limited to 50 years conditioned upon acceptance of all the terms and conditions of the act. (Sec. 6.)

"(a) The right of the United States or any State or municipality is expressly reserved to take over by condemnation proceedings and maintain and operate the project at any time during the 50 years license period upon payment of just compensation to the licensee therefor." (Sec. 14.)

That is, during the 50 years there is the right reserved in the United States to take over the property on paying just compensation.

"(b) At the end of 50 years, the right is reserved to the Government to take over the project upon payment of the net investment by the licensee, but not to exceed its fair value, and excluding any consideration for good will, going value, or prospective revenues. (Sec. 14.)

"(c) At the end of 50 years, in event the Government does not exercise the right to take over the project, preference is given to applications by States or municipalities. (Sec. 7.)

"(d) No preference right for renewal of the franchise or any proprietary claim for power is secured to the licensee. If a license is renewed, it must be under the then existing law and regulations. (Sec. 15.)

"4. The licensee can not execute a transfer of any right secured under the license or of property under license without the written approval of the power commission. All transfers or assignments, whether by judicial sale or foreclosure, must be subject to the conditions of the act. This provision is

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construed by the present power commission to extend to a lease of any property under license. (Sec. 8).

"5. The licensee is required at its own expense, under the supervision of the power commission at all times, to maintain the project adequately for purposes of navigation and efficient operation in the development and transmission of power, must make all necessary renewals and replacements and maintain adequate depreciation reserves. (Sec. 10c.)

"6. The licensee is required to provide, free of cost, power for operation of all navigation facilities (sec. 11c), and authority is reserved in the Government at all times to prescribe regulations in the interest of navigation including control of the pool level and installation of necessary lights and signals. (Sec. 18.)

"7. A licensee which is a public utility corporation must abide by such reasonable regulation regarding the services rendered its customers and its rates and charges of payment therefor as may be prescribed by the State; and if there be no laws of the State regulations, rates, services or security issues, then the Federal Power Commission exercises such regulation (sec. 19), and if the power enter into interstate commerce and the States can not agree, then the Federal Power Commission makes such regulations. (Sec. 20.)

"8. All power sold in public service entering into interstate commerce must be 'reasonable, nondiscriminatory, and just to the customers, and all reasonable discrimination and unjust rates or service are hereby prohibited and declared unlawful.'" (Sec. 20.)

Even where the licensees sells to another company for resale to the public, the act undertakes to regulate rates, service, and security issues of that purchaser from the licensee, in the event there is no local regulation.

"9. After 20 years of operation amortization reserves are required out of surplus earned thereafter; if any in excess of a specified reasonable rate or return upon the actual, legitimate investment to be held until the termination of the license or applied, in the discretion of the power commission, in reduction of the net investment of the licensee. (Sec. 10d.) This rate has been fixed by the rules and regulations of the power commission.

"10. The licensee is required to make equitable contribution for benefits accruing to it from headwater improvements either by storage reservoirs or otherwise, whether done by other licensees or by the Government." (Sec. 10f.)

An important provision, Mr. Chairman. That is one of the more or less uncertain obligations assumed, but which the licensee must assume.

"11. 'Combinations, agreements, or understandings, expressed or implied, to limit the output of electrical energy, to restrain trade, or to fix, maintain or increase prices for electrical energy or service are prohibited.' (See 10h.)

"12. The right is expressly reserved to the United States at any time, in the opinion of the President, to take over the project when the safety of the United States demands, for 'manufacturing nitrates, explosives, or munitions of war, or for any other purpose involving the safety of the United States,' involving a liability only for just and fair compensation for use of the property taken, to be determined by the power commission upon a basis of a reasonable profit to the licensee in peace time, plus the cost of restoring the property to as good condition as when taken, less a reasonable value for improvements made by the United States that are serviceable and valuable to the licensee." (Sec. 16.)

The offer of Mr. Ford requires the Government to protect the company from losses by such use and to return the property in as good condition as received, plus reasonable compensation for the use thereof.

"13. The United States court is vested with authority to revoke for violation of its terms any licenses issued thereunder, or to remedy or correct by injunction, mandamus, or other process any act or order of commission or omission promulgated thereunder, in violation of the act or of any lawful regulation issued thereunder."

Now, Mr. Chairman, it appears from the first annual report of the Federal Power Commission that to November 1, 1921, licenses were issued for power developments totaling 1,280,055 horsepower, and that applications were pending as of that time for an additional installed capacity of 16,826,255 horsepower.

Since November last certain applications have been granted and licenses issued increasing the total power development now in progress and under construction under license to approximately 1,500,000 horsepower.

During the period beginning November 1, 1920, and ending February 1, 1922, there were issued and sold high-grade investment securities of lighting and power companies in the total amount of $472,450,000, of which total $145,493,000

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were issued and sold by hydroelectric companies. An examination of these securities issues shows that the bulk of them were sold during the period of November and December, 1921, and January, 1922.

It is estimated that for 1922, and for the next several years, $733,000,000 per year will be required to maintain electric-light and power facilities equal to the growing demand throughout the country.

The output of electrical energy during 1921 totaled 43,100,000,000 kilowatt hours, of which 26,000,000,000 kilowatt hours of energy was derived from fuel and 17,100,000,000 kilowatt hours of energy was derived from water power.

Of this total output the privately owned companies generated slightly more than 97 per cent of the total electrical energy produced in the country.

Now, I have recited these statements for this reason. When it is considered that a large amount of steam energy being used can be produced by water power, and that if the great burden of meeting the growing demands in this country from year to year for power is to be met by the privately owned companies, it is apparent that the national policy of the Government, as expressed in the Federal water-power act, is of great public importance to the end of obtaining continued, consistent development of the hydro resources of the country. In no other way can the great volume of funds be raised than by following this consistent policy.

I am led to make this statement because the Muscle Shoals situation is by one plan proposed to be developed for the benefit of one of the proposers under a plan which amounts virtually to a great Government subsidy, and, in fact, it will seriously handicap the developments which ought to be made in that great territory by others unless there is a purpose in behalf of the Government to go forward and undertake all of the hydro developments. When it is considered that upward of $700,000,000 per year should go into the hydroelectric industry over this country, you can appreciate the great burden which the Government would be under if it were planning a consistent policy to supply the further needs of the country.

The companies engaged in power development are making their plans in many parts of the country to go forward under licenses granted by the Federal Power Commission. This law is restrictive in many respects, but it is quite possible to finance and develop many of the greatest projects in this country under the law.

The CHAIRMAN. Let me see if I understand you now. I was interrupted, and would like to follow you all the way through.

Your contention is that the Government ought not to go into the business of developing this hydroelectric energy unless it covers the whole field. Is that the idea?

Mr. MARTIN. My contention is more directed to the consideration of the question of development in the interest of one of the proposers using Government funds and under conditions which amount virtually to a Government subsidy for the benefit of one individual. Our position is simply that licensees under the Federal water power act must provide their own funds, make their own development, assume numerous obligations, which we have briefly referred to; and in fairness to all who undertake power development in this country it seemed that all should be upon the same basis of development.

Senator HARRISON. May I ask you when did you make your proposal to complete the work at Muscle Shoals?

Mr. MARTIN. Our first proposal was made, Senator, in 1913.

Senator HARRISON. 1913?

Mr. MARTIN. Then again in 1916. We donated the property of the Wilson Dam site to the Government in 1918. Our next correspondence after those years was in 1921.

Senator HARRISON. Are those proposals much the same as your present proposal?

Mr. MARTIN. No, sir.

Senator HARRISON. They were quite different?

Mr. MARTIN. They were different. They were set up on a different principle.

Senator HARRISON. Were you influenced in making this proposal by the proposal of Mr. Ford?

Mr. MARTIN. We have always been interested in the situation.

Senator HARRISON. I understand you have, and you have made the great development down there; but was it Mr. Ford's offer that caused you to make this particular proposal?

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Mr. MARTIN. When it became apparent that the Congress proposed to go forward and complete the project, and devote at least a part of the energy to public service, it was that, together with the fact that important parts of our property were involved, that caused us to submit the proposal. We advised the Chief of Engineers in May, 1921, that we were prepared, whenever the Government desired to place any part of this power in commercial service, to work out a plan that was satisfactory to the Government, so far as we could. That letter has been placed in the record.

The CHAIRMAN. Was that before the Ford offer was made?

Mr. MARTIN. Yes, sir. We had numerous discussions with the Chief of Engineers, and which resulted in our letter of May 28, 1921, followed by another letter to the Chief of Engineers in July, 1921, both of which were placed in the record on yesterday.

Senator HEFLIN. Was any mention of those suggestions ever made by the Secretary of War that you know of?

Mr. MARTIN. Yes; he mentions them in his testimony.

Now, I wish, Mr. Chairman, to place in the record a very brief summary of classes of service our company is rendering the public in Alabama. Our company, from five customers in 1914, with a load of 7,500 horsepower derived from two municipalities, one cement plant, one brick plant, and one cotton mill, has increased that load so that at the end of the past year our connected load was 370,000 horsepower, with an electrical output of 500,000,000 kilowatt hours annually.

At the present time the Alabama Power Co. is rendering service to 158 major industries, or classes of users, consisting of:

Ratio to total consumption.

		Per cent.
2	brick plants	0.25
2	cement plants	6.67
46	coal mines	7.46
30	cotton mills	21.50
7	cotton gins and oil mills	.52
11	foundries and machine shops	.70
5	graphite plants	.04
7	ice plants	.61
9	ore mines	2.16
1	manganese plant	6.84
3	municipal lighting systems	.46
3	municipal pumping plants	.31
18	public utilities	37.85
8	lime and marble quarries	2.02
4	steel plants	12.10
1	United States Government—nitrate	.49
1	United States Government—camp	.02
158		100

These various classes of industries will consume approximately 70 per cent of the total power output; that is, the industries, notwithstanding the fact that from this system there is furnished the house lighting, street lighting, and street railway operation to a total of 63 municipalities, these industries will consume 70 per cent. In other words, the greater part of this energy goes to industries throughout the State.

The CHAIRMAN. Are all of those customers in the State of Alabama?

Mr. MARTIN. Yes, sir. Now, I wish to mention one typical example——

Senator HARRISON (interposing). Will you put in the record the names of the directors of the Alabama Power Co.

Mr. MARTIN. Yes, sir. They are as follows:

Board of directors of Alabama Power Co., Birmingham, Ala.: Thomas W. Martin, Birmingham, Ala.; W. N. Walmsley, Birmingham, Ala.; Lawrence MacFarlane, Montreal, Canada; W. H. Hassinger, Birmingham, Ala.; C. E. Groesback, New York City; R. M. Hobbie, Montgomery, Ala.; W. J. Henderson, Montreal, Canada; F. M. Moody, Tuscaloosa, Ala.; Harold S. Swan, New York City; Gerhard M. Dahl, New York City; W. H. Weatherly, Anniston, Ala.; S. Z. Mitchell, New York City; R. A. Mitchell, Gadsden, Ala.; Walter M. Hood, Birmingham, Ala.

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The CHAIRMAN. What is your capital stock?
Mr. MARTIN. $18,751,000 of common stock.
The CHAIRMAN. Paid up?
Mr. MARTIN. Yes, sir; plus various issues of preferred stock.
The CHAIRMAN. You have issues of preferred stock?
Mr. MARTIN. Yes, sir.
The CHAIRMAN. How do you happen to have preferred stock?
Mr. MARTIN. We sell preferred stock and bonds to raise new capital for additions and extensions to our system. There is one important point which must always be kept in mind in dealing with this subject, viz: That public utilities are subject to regulation by public-utility commissions of the State in which they operate, other business enterprises are not. Our company being a large enterprise, is called on constantly to enlarge its service. It must, of necessity, therefore, seek a broad field for the sale of its securities because it is not permitted to earn a return sufficient to enable it to meet these requirements for funds. State regulation of rates and securities does not permit this company, nor any other regulated utility, to accumulate money for improvements and extensions. It is a fundamental principle of public-utility regulation as laid down by the courts and commissions that the earnings shall be sufficient only to pay operating expenses, taxes, provide for depreciation, and, in addition, a fair return on the property employed in the service of the public. This limitation of earnings to a fair return makes it necessary that the utility make additions and extensions to its property out of new capital. Obviously, we can not sell bonds secured by mortgage to provide the entire amount of this new capital. The present-day investor will not purchase a bond unless part of the funds for the work are provided from stock or some other similar source. Therefore, our company, and many others, have worked out the plan of selling bonds to provide the principal part of the money needed, the balance to be provided by the sale of common or preferred stock.

The reason for this principle of rate regulation is obvious. The utility can not make the customer of to-day pay (in his rates for service rendered) for the cost of improvements or extensions from which only the coming generation of customers may benefit. In other words, the customer of to-day should pay only the cost of serving him to-day, including depreciation, and a fair return upon the property; but he can not be required to contribute, in addition to his rate, money for improvements and extensions. This must always come from new capital.

This new capital for new work in the way of extensions and additions does not, of course, weaken the position of previous investors in the company securities, because these extensions and additions serve to add to the value of the property and its ability to handle a greater volume of business. The rule that the company is entitled to a fair return upon the value of its property applies to the new capital as well as to the old. As an extension or improvement is made, that investment becomes a part of the value of the property, upon which the company is entitled to a fair return.

The CHAIRMAN. Is there any water in any of the stock?
Mr. MARTIN. No, sir.
The CHAIRMAN. Some of the stock was issued for property?
Mr. MARTIN. Yes, sir.
The CHAIRMAN. How was the value of the property appraised?
Mr. MARTIN. That has been some years ago, Senator.
The CHAIRMAN. Where is the majority of the stock held?
Mr. MARTIN. The majority of the stock is about something in excess of 40 per cent, 40 to 45 per cent, owned in Alabama and other States of this country. There is a small percentage owned by various citizens of Canada.
Senator HARRISON. What percentage of the stock?
Mr. MARTIN. Well, possibly 5 to 8 per cent in Canada. The balance is owned in foreign countries, principally England.
The CHAIRMAN. That would mean about 50 per cent in European countries?
Mr. MARTIN. Foreign countries. Possibly. That was due to this situation: When these developments were projected in 1912, and prior to that, the citizens of our State sought everywhere in this country and in foreign countries to find people with money to make developments. Captain Lay, a citizen of our State, who is well known to Senator Heflin, was possibly the prime mover in getting capital. He interested, after many years of effort, Mr. James Mitchell, a citizen of this country, and in 1912 Mr. Mitchell undertook to take up this power de-

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velopment. He financed the development principally in England and other foreign countries.

I am frank to say there was a lack of confidence—I am afraid that there was a great lack of confidence in these developments in this country. Mr. Mitchell obtained money from abroad and went forward with a policy of development.

When the war began in 1914 it became necessary to alter the entire plan of financing. Whereas prior to 1914 the securities were principally held abroad, since 1914 and down to the present time the situation has been reversed because of conditions which have been developed in these hearings. More confidence became evident on the part of investors in this country, and since our pioneer developments, and as a result of the pioneer developments, the investing public has come to look with favor upon the development, and our company has gradually been able to sell its securities on a better basis from year to year, and has found ready markets and is finding ready markets for its securities now. So that out of our total issue of securities at the present time there is in excess of 60 per cent, approximately 63 to 65 per cent, of all the securities held in the United States—all classes of securities. The balance are held—35 per cent or possibly just a little more—in Canada and other foreign countries.

Those foreign-owned securities, or a part of the securities originally held abroad, have returned to this country since 1914 in large volume, due to conditions which you gentlemen are familiar with, namely, exchange conditions and war conditions; the fact that the market value of such investment went down, and for one reason and another they have been returning to this country in large volume.

Senator HARRISON. Is your stock listed on the stock exchange?

Mr. MARTIN. No, sir.

Senator HARRISON. Are the securities held pretty generally, or are they——

Mr. MARTIN. Yes, sir; they are widely owned.

Senator HARRISON. The business has been and is fairly successful?

Mr. MARTIN. To this extent. Our company has paid all of its fixed charges. There have been no dividends on stock except on the issues of preferred stock sold in the last few years, which we have sold entirely to the public in this country—in Alabama and other States. Dividends have been paid on those issues, but earlier issues of securities, preferred and common, have never had any dividends. The company has been successful in extending its business, and what surplus the company has been able to make has gone back into improvements and extensions from year year instead of into dividends.

Senator HARRISON. Your operation is pretty well localized in that State?

Mr. MARTIN. Our operations are localized entirely in the State, from Montgomery on the South——

Senator HARRISON. That is, you have none in any other part of the country?

Mr. MARTIN. No other interest, except in Alabama.

Senator CARAWAY. Mr. Martin, how much of your power is developed or generated by water?

Mr. MARTIN. At the present time, about 85 per cent.

Senator CARAWAY. That is capable of being increased?

Mr. MARTIN. We are developing a new hydroelectric station now which will supply, we hope, 95 per cent of the time, all the power we need for the next year or two, supply all the hydro power for all development.

Senator CARAWAY. You have a market now for all the power you generate and will take on at those two projects?

Mr. MARTIN. We are taking on new consumers.

Senator CARAWAY. Have you got the power to do it?

Mr. MARTIN. We have not, and for that reason, anticipating the demands for power, we obtained from the Secretary of War last fall a lease of the Sheffield steam plant, subject to termination at the pleasure of the Secretary of War to enable us to supply demands arising during the present year and which, after the present year, we will carry on the new hydroelectric plant on the Coosa River.

Senator CARAWAY. Are there any additional sites for water-power development on the river?

Mr. MARTIN. Yes.

Senator CARAWAY. Do you own that site, or your company?

Mr. MARTIN. We own two additional sites; one additional site and some holdings at another site.

Senator CARAWAY. Does that give you a complete control over the water-generated power in that country, or are there other sites?

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Mr. MARTIN. We have some other sites in our storage developments on two other rivers.

Senator CARAWAY. Are there any that are not controlled by your company except Muscle Shoals? About how much power can they develop besides Muscle Shoals? I don't want you to go into a big long statement.

Mr. MARTIN. We have estimated somewhere between five hundred thousand and a million horsepower in various developments in Alabama in which we have no interest.

Senator CARAWAY. A million horsepower?

Mr. MARTIN. Five hundred thousand to one million horsepower.

Senator CARAWAY. Five hundred thousand to a million that could be developed at power sites that you do not own?

Mr. MARTIN. Yes, sir; and outside of Muscle Shoals.

Senator CARAWAY. Are there consumers enough to absorb that much power?

Mr. MARTIN. Not at the present time. Well, I won't say at the present time.

Senator CARAWAY. You pretty well cover the field now?

Mr. MARTIN. Well, we are endeavoring to meet the demands in the territory which our lines reach, and endeavoring to meet other demands in other sections, but we can not meet them.

Senator HEFLIN. Do you serve any municipalities outside of Alabama and Tennessee or Georgia?

Mr. MARTIN. No, sir. We have no service outside of Alabama.

Senator CARAWAY. You spoke of serving 18 public utilities. Does that mean street car lines?

Mr. MARTIN. Several street car lines.

Senator CARAWAY. And what other that you class as public utilities?

Mr. MARTIN. I have reference to other concerns that are classed as public utilities, other companies engaged in public service.

Senator CARAWAY. What kind of public service?

Mr. MARTIN. For instance, the Birmingham Railway & Power Co.

Senator CARAWAY. What is that company?

Mr. MARTIN. They have a street railway and also supply the light and power in the district known as Greater Birmingham. All of their electric energy is provided by our company.

Senator CARAWAY. Do you furnish all of the electric energy to Birmingham?

Mr. MARTIN. We do.

Senator CARAWAY. If Muscle Shoals is developed and you do not have control of it, will it be in direct competition with your company?

Mr. MARTIN. Well, I don't know how that will work out, Senator.

Senator CARAWAY. Apparently it would?

Mr. MARTIN. Well, Mr. Ford's engineers have figured on not engaging in any public service. On the other hand, there is some intimation that he would. I don't know.

I want to mention one example of growth and increased use of power in our State.

Some time prior to 1911 the communities of Anniston and Talladega having a population of 18,648, had a combined power load of say 2,000 horsepower. It was planned by the citizens of the State of Alabama to serve those communities from what is known as the Jackson Shoals power development with electric lighting and power by erecting a hydro plant at what is known as Jackson's Shoals on Chocolocco Creek. Sufficient local capital could not be obtained for this purpose and foreign capital was sought. After much delay the owners of the company succeeded in financing it. The water-power plant was constructed with 2,000-horsepower capacity in 1911. It soon appeared, however, that the increased demand for power was such that it could not even supply one of these communities and arrangements were made by which the Alabama Power Co. came into the situation in 1913 and purchased that power development at Jackson Shoals, combining it with its present system. Those two communities of Anniston and Taladega were at that time supplied from that small power development, and from a demand of something less than 2,000 horsepower in those communities in 1911 the demand increased for lighting and power to 45,000 horsepower at the peak of the war demand in 1918, which the power company supplied from its system. It will be seen, of course, at once, that no such development as was originally planned, 2,000 horsepower, would in any way have met the local needs. There are now located in Talladega and Anniston cotton mills, pipe plants, foundry and machine shops, and a variety of businesses which are dependent upon power such as our system supplies for their efficient operation.

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This community's greatly increased use of electrical energy is typical of the growth and use of many communities in our State, though not as large as that.

The CHAIRMAN. Mr. Martin, is not that always dependent upon the price at which power is supplied?

Mr. MARTIN. Absolutely.

The CHAIRMAN. If your company in those communities where this wonderful development has taken place had not supplied power at a cheaper price than it could be obtained elsewhere that development would not have taken place?

Mr. MARTIN. That is correct, Senator.

The CHAIRMAN. So that it must always follow, if there is to be development from the building up of hydroelectric stations, that the power furnished must be cheaper than the existing power or there will be no development?

Mr. MARTIN. Yes, sir.

The CHAIRMAN. And that development always follows where cheap power is generated. Is not that true?

Mr. MARTIN. Yes, sir.

The CHAIRMAN. And developments of that kind, locally, in a radius of five or six hundred miles, are going to depend upon what they have to pay for this energy. Is not that true?

Mr. MARTIN. Yes, sir.

The CHAIRMAN. It will not develop unless they can get cheap power.

Mr. MARTIN. Yes, sir; that is quite true, Senator.

The CHAIRMAN. If they can not get it cheaper than other communities can supply it, naturally the development of machine shops and all other kinds of users will go into that other community?

Mr. MARTIN. Yes, sir. I might mention that the Department of Commerce publication, issued in 1920, shows in table No. 28 that the average cost per horsepower year to consumers of electric power in Alabama had decreased 70 per cent in the decade between 1907 and 1917.

Senator HARRISON. Have you there the figures that show the decrease at Buffalo, say, and Niagara?

Mr. MARTIN. May I just complete this, Senator?

Senator HARRISON. Yes.

Mr. MARTIN. On the other hand, the cost per horsepower year to consumers of electric power in the State of Mississippi had decreased only 4 per cent in the same period, thus evidencing the great influence on power costs of hydroelectric development. The fall line vanishes when you get down into Alabama. There are no further developments possible west of Alabama.

The CHAIRMAN. There is not fall enough in the river?

Mr. MARTIN. No. That 70 per cent decrease in the cost of power is reflected in the increase of industries in our State. Here is a chart which will indicate to you how industries have developed in various Southern States as a result of the increased use of power or as a result of the availability of power. You will see the difference in such States as Mississippi and Alabama. Alabama shows a variety of industries greater than any of the States shown.

The CHAIRMAN. This map shows great increases have taken place in Alabama, Georgia, South Carolina, and North Carolina?

Mr. MARTIN. And in Tennessee.

The CHAIRMAN. And in Tennessee, yes; and no development seems to have taken place near the coast line. I presume that is because the country gets flatter as it goes down toward the river?

Mr. MARTIN. Yes, sir.

The CHAIRMAN. There is no fall in the river?

Mr. MARTIN. Yes, sir.

Senator HARRISON. It may be that this is already in the record. I am not sure. But I think it would be well if we could get a comparison of the prices of electric energy at Niagara and Buffalo, so as to compare it with what you have in Birmingham and other cities.

Mr. MARTIN. I will have to get you that later, Senator.

Senator HARRISON. Do you know whether or not it compares favorably in price?

Mr. MARTIN. Yes.

The CHAIRMAN. There has been a great reduction in price up there since the Niagara development?

Mr. MARTIN. Yes, sir.

The CHAIRMAN. I can not give the figures, but I have read them.

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Mr. MARTIN. Of course, you must bear in mind that at Niagara there is a great reservoir of water and there is no variation in the stream flow.

The CHAIRMAN. Then at Niagara they have what you would have in the Tennessee River if we were able to build storage reservoirs that were practical?

Mr. MARTIN. Without the expense of storage.

The CHAIRMAN. Without the expense of building the storage. That is true.

Senator HARRISON. Some four or five years ago, in the investigation of the Niagara Falls project, it appeared that the prices were very high, and the people up there were up in arms against the company, against the company's charging such high prices. I wish you would put into the record, if you can, a comparison of the price that we charged at Buffalo, say, and Niagara, and then compare it with Birmingham and Anniston.

The CHAIRMAN. Senator, some of the prices that he gave yesterday that consumers paid down in Alabama were outrageously high, I think.

Senator HEFLIN. He mentioned Opelika particularly.

The CHAIRMAN. The consumers paid as high as 12 cents per kilowatt hour for electric light in their homes.

Senator HARRISON. Of course, the greater the distance of transmission of energy the higher the price, is it not, generally?

Mr. MARTIN. That is true, Senator, in some systems. I would like to say, however, that the prices mentioned by the chairman as being high were the prices charged the public by municipally owned lighting systems. Take the Ontario power system, which has been developed by the government of Ontario. There the price varies with distance for all classes of users. It is the policy, however, of all central-stations companies of this country, such as ours, to endeavor to maintain a schedule at all points of the system the same.

Senator HARRISON. The prices in Canada are much cheaper than the price over in the United States for the same power?

Mr. MARTIN. I don't know that I want to say that, Senator.

Senator HARRISON. It was some years ago, unless it has been changed.

The CHAIRMAN. The witness may not be informed on the subject, and I may be wrong about it, but my understanding has been that the prices to consumers in Canada as compared to the prices to consumers on this side of the line for power developed from Niagara in both cases are very much cheaper.

Mr. MARTIN. There is a very wide variance between prices paid by consumers in different localities in Ontario. You will find a very elaborate treatment of this question in a recent publication by Mr. W. S. Murray, in which he made a survey of that whole question, comparing prices on the Canadian side with prices on the American side, and also the prices in California.

The CHAIRMAN. Where did you say we will find that?

Mr. MARTIN. I will hand you a volume of it, if you wish to have it.

The CHAIRMAN. I think it would be a good idea to put that in the record.

Mr. MARTIN. It is a volume of 500 pages, Senator, but I will put a synopsis of the report in the record at this point.

EXHIBIT A.

Memoranda of facts and conclusions contained in the report of Messrs. Murray and Flood of March, 1922, on the development and operation of the electric light and power utilities of the Hydro-Electric Power Commission of Ontario:

The engineering firm making the report is comprised of Mr. W. S. Murray, who conducted the superpower survey on the Atlantic seaboard between Boston and Washington for the Department of the Interior of the United States Government and who, in addition, is conversant with Canadian conditions, having acted in a consulting engineering capacity for municipal and provincial bodies, and Mr. Henry Flood, jr., formerly engineer-secretary of the United States Government superpower survey organization.

Government ownership and operation of electric light and power utilities, as exemplified by the Hydroelectric Power Commission of Ontario, is not a success from the viewpoint of either service or low cost, as compared to privately owned and publicly regulated electric light and power companies in the United States and Canada.

This in effect is the outstanding conclusion in the report made to the National Electric Light Association by Messrs. Murray and Flood. It is buttressed by a mass of contributory evidence gathered first-hand by the engineering firm in an

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exhaustive investigation begun on August 22, 1921, and covering the period up to February 10, 1922, when the report was presented.

The printed report contains more than 225 pages of printed matter and charts. In it the engineers trace the development of the Hydroelectric Power Commission of Ontario since its inception. They compare its growth and operation with the growth and operation of electric public utilities in the Province of Quebec and in sections of the United States, and give comparative and pertinent statistics on the bonded debt, revenue, operating expenses, taxes, wages, etc., of municipally owned and privately owned Canadian electric utilities.

The investigation was made for the purpose of obtaining complete economic data from which to draw a comparison between governmentally owned and privately owned utilities. This naturally led to a consideration of the political and economic structure of the Hydroelectric Power Commission of Ontario, which operates the largest Government-owned system in existence, and to a comparison between that system and others privately owned and operated, but subject to public regulation both in the United States and Canada.

In the report Mr. Murray is careful to state that it is not intended to dim the glory of the achievements of the Hydroelectric Power Commission of Ontario, which, he says, has replaced certain unregulated private utilities whose operation was far inferior to it. The principal problem was to determine whether there was anything in the Ontario plan to commend it for application in the United States.

In summarizing the results of the investigation the report asserts that no system of electric service such as that operated by the Hydroelectric Power Commission of Ontario is applicable in the United States, for the reason that it is subversive of American policy and custom, and in addition is inefficient, expensive, and wasteful. It shows that the service rendered by privately owned utilities under public regulation is cheaper and better than that rendered by governmentally owned utilities, and that even in Ontario, which has what is generally looked upon as the most successful example of Government owned utilities, private capital and enterprise have contributed more to the upbuilding of civic, industrial, and commercial life than has the Government owned project.

In the summary of conclusions at the front of the report appears the following:

"After careful analysis of the governmentally owned, controlled, and operated electric utility structure as represented in the Hydroelectric Power Commission of Ontario, I am of the opinion, firstly, that the principles of its application can find no place in the United States; secondly, that to attempt the substitution of its principles of control and operation within the States would be to strike a blow at economic structures, the present existence of which are not only far better equipped to protect the public interests in their conjunctive relation with the public service commissions of the States regulating their rates, but it would also be to strike an equal blow at the shareholders of the electric utilities which are now serving the American public; and, thirdly, that the Hydroelectric Power Commission owes its being only to the fact that a public service commission on the the order of those operating in the States was not in existence in the Province of Ontario at the time of its creation."

In support of the above statement the report recites that in order to be superior in kind to that supplied by the privately owned electric utilities of the United States, power as applied in Ontario from the governmentally owned and controlled system, in associate relationship with the Hydroelectric Power Commission, must be more adequate, more reliable, and cheaper. "The facts show, however, that the electric utilities of the States hold more power in reserve and sell more energy per capita served," says the report, "that, by that token they can claim a greater reliability of supply and that the supply is cheaper to the consumer."

Also in support of the statement of conclusions the report asserts that at the end of the fiscal year 1920 only 23 per cent of the total power-plant capacity operated by the Hydroelectric Power Commission was constructed by the commission, the remainder representing plant capacity, was constructed at the initiative and risk of private investors and acquired from those investors by the commission. The report states that in acquiring ownership of it, intangibles, such as franchise rights and good will, were included in the purchase price. This intangible cost, therefore, being represented in power "at cost," such intangibles also necessarily would be included in the cost

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of any governmental plan of like characteristics which might in the future be inaugurated in the United States.

"The building of new power-plant facilities under the auspices of governmental ownership, as shown in the cases of Nipigon and Chippewa, both in respect to policy and to cost, is not to the economic interest of the people," continues the report.

"The advocates of Government or municipal ownership of electric utilities claim reduction in the cost of power in virtue of: (*a*) Elimination of taxes; (*b*) elimination of dividends; (*c*) elimination of high-salaried executives; and (*d*) more economical wages and higher efficiency in labor scale.

"With regard to (*a*) the taxes are not eliminated. Just as much money in taxes is paid. The difference is in their distribution. In the case of private ownership only the users of service pay the tax bill, while in the case of Government owned utilities all the people pay the bill.

"With regard to (*b*), (*c*), and (*d*), notwithstanding dividends, high-salaried executives, and the wage and labor claims, the answer is, when the total operations are sumed up, the people receive the power at less cost through private ownership under regulations.

"The investment of capital in electric utilities under private-interest control is far better protected from extravagance than when that capital is governmentally owned for the reason that plans and estimates for such capital expenditures not only must gain the approval of a trained engineering and managerial staff and an experienced board of directors of the companies, but it also must have the critical review of the bankers and the private financial investors. In the case of Government owned utilities the directing heads are seldom specially trained in the business under their jurisdiction and the value of securities is not based upon the value of the property or the efficiency of the management but upon the taxing power of the Government.

"Arms, legs, and body are useless without the head. A high-salaried executive usually saves many times (his salary included) the losses incurred by the cheaper and less efficient executive. Accomplishment by individuals in control of private enterprises is under keener observation than is the case when those in charge are governmental or municipal officers.

"Governmental ownership eliminates all incentive for gain and throttles initiative. This is evidenced by the far greater growth of privately owned utilities.

"The Hydroelectric Power Commission is the judge of its own acts. A commission can not fairly be the judge of its own (and others) rights in contentions."

Further, in support of the conclusions drawn the report calls attention to the fact that "honesty of purpose does not necessarily reduce the power bill," but that so far as price is concerned the structure under which it is administered is what really counts. The report says that American companies in the Niagara district are supplemented by steam power far more than are those on the Canadian side, but that in spite of this increased cost for the benefit of the consumers and the public generally power is being furnished at a lower cost on the American side than upon the Canadian side under the direction of the Hydroelectric Power Commission.

In discussing the relative value of the governmental structure as represented by the Hydroelectric Power Commission of Ontario and the regulatory bodies of the several Commonwealths of the United States the report says:

"The commissions of the States fully realize that protection to the people lies in protection to the electric utilities from which they are receiving power. The authority delegated to them to regulate rates and the constitutionality of the law standing behind any action on their part or upon the part of the electric utilities provides a structure constructively balanced to do justice to all parties."

Throughout the report Messrs. Murray and Flood praise the personal integrity and honesty of purpose of Sir Adam Beck, chairman of the Hydroelectric Power Commission of Ontario, and his associates and staff. They also accredit Sir Adam Beck and Mr. F. A. Gaby, chief engineer of the commission, for their fair and unbiased attitude in furnishing facts upon which the report, including its summary of conclusions, is predicated. Throughout the report copies of correspondence between Mr. Murray and Sir Adam Beck and Mr. Gaby show that the figures and other statistical material used as a basis for the report are most conservative, and were furnished by those two officials of

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the commission with full knowledge of the fact that they were to be embodied in a report.

In a letter dated September 9, 1921, Mr. Murray addressed Sir Adam Beck, and after explaining the commission given him by the National Electric Light Association, stated:

"The report I am to render, while having much to do with the two former subjects (engineering and construction features of the commission's projects with which Mr. Murray was conversant because of his previously having been retained for a period as consulting engineer) is more particularly related to the political and economic structure as existing in the States and in Ontario, and you, therefore, will understand that I would take an impossible position to refuse to attempt collecting the complete facts of both situations, and be governed in my conclusions by them."

In the same letter Mr. Murray inclosed a set of questions prepared by him. The answers to these questions form the real basis for the subsequent investigation conducted by the engineering firm.

The Murray and Flood report, which consists of 226 printed pages, including 41 color plates and diagrams visualizing the statistics given, details the history of the origin and development of the Hydro-Electric Power Commission, stating that—

"The plan of governmentally owned and operated electric utilities grew out of the belief by seven municipalities lying within transmission distance of the Niagara Falls that power therefrom could be generated and transmitted to them at a cost far less than that being paid for the supply received from private companies"—

and that later the plan spread through the Province of Ontario until to-day more than 200 municipalities are receiving Hydro-Electric Commission power. The movement started in 1900, when the Ontario Power Commission estimated that a generating plant at Niagara, with contemplated capacity of 30,000 to 100,000 kilowatts, could be constructed upon a basis which would make possible the delivery of electric energy at a cost of $4.95 per horsepower year. Following the report of this commission, its successor, the Hydro-Electric Power Commission, was created in 1906, and was given almost unlimited authority and power, even to the extent of the making of contracts for, and the issuance of, bonds in any amount which should be valid claims against the municipalities and the Province. Additional powers have been granted since the original organization of the commission.

At the outset the commission elected to purchase power from existing companies rather than to construct generating plants and distribution systems. In line with this decision it contracted with the Ontario Power Co. of Niagara Falls for power to be supplied to municipalities of Ontario at a cost of $9.40 per horsepower year for the first 25,000 horsepower, and $9 per horsepower year for all power in excess of that amount. This was a 10-year contract, to expire in August, 1917, but in 1916 the commission's requirements had grown to such an extent that it was necessary to purchase additional power from the Canadian Niagara Power Co., at the rate of $12 per horsepower year. Under this contract the company was selling an average of about 68,000 horsepower per year to the commission.

Under the Hydro-Electric Power Commission act all electric power must be sold at cost. Naturally, the power produced at Niagara is produced at the lowest cost, not only within the Province of Ontario, but upon the entire American Continent. This power is transmitted to municipalities, frequently within the same zone as other municipalities receiving electric light and power service from other generating sources. The result is a wide variance of costs because of the difference in generating costs. Under the system of rate making and public regulation in the United States (California is used as a typical State), as well as in Quebec, it is the aim of electric light and power companies and of regulatory commissions to equalize costs so that as far as possible all communities will be upon an equal basis so far as power costs are concerned, and will not be favored nor penalized because of geographic adjacence to or distance from natural power resources. In making its charges the commission uses an "interim," or estimated annual rate. At the end of a fiscal year the municipality purchasing power is either credited or debited with the difference between the estimated rate and the actual cost of producing and delivering the power. The highest "interim" wholesale rates quoted in the 1920 annual report of the commission were between $80 and

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$90 per horsepower year. The highest actual rates paid were between $150 and $160 per horsepower year. Nine municipalities paid a rate higher than the maximum rate quoted, which rate, says the report, generally is the one given for public information.

Further, in comparing costs of power to the people of Ontario with the costs of power received by the people of the States, in the Province of Quebec, the report says: "It is important to remember that Niagara Falls, combining its continuing flow of water with its high head, should make the production of continuous power the cheapest for any part of the American continent. This should be kept in mind especially when comparison is drawn for the California situation, where the hydroelectric power developments are small in capacity and are subject to variation in stream flow, thus requiring that their systems be supplemented with steam-electric plants"; also, that Ontario had only 35 per cent as many miles of transmission lines as California and that California transmissions served only 483 inhabitants per square mile, as against 587 inhabitants per square mile in Ontario.

Commenting upon this comparison, the report says that in the Niagara district of Canada the Government-owned electric utilities furnish power at an actual average cost of 9.25 mills per kilowatt-hour generated, while the private electric utilities of the same district furnish it at 7.6 mills per kilowatt-hour generated. The weighted average of these two is 8.78 mills per kilowatt-hour. Also, that in the United States for a comparable zone supplied by Niagara Falls power, the average price of power to the consumer is 7.65 mills per kilowatt-hour generated. The report does not contain data with regard to power costs in Alabama, but the comparable figure for power generated by Alabama Power Co. was 7.45 mills per kilowatt-hour.

"In the Province of Quebec, where power to the extent of 96 per cent is generated by private electric utilities and where the general zone of transmitted power is not unlike that of Ontario, the average cost to the consumer is 6.6 mills per kilowatt-hour generated."

The report further points out that existing contracts for the purchase of the Ontario Power Co. by the Hydro-Electric Power Commission included existing contracts to supply power to American and Canadian companies at 2.53 mills per kilowatt-hour generated, which results in Canadian municipalities of the Niagara system of the Hydro-Electric Power Commission paying 11.1 mills per kilowatt-hour, instead of the purchase price of 9.25 mills.

From these figures it is apparent, says the report, that both in Quebec and the United States the average price of power to the consumer is less per kilowatt hour when produced by private companies than when produced by Government-owned utilities. In the several considerations taxes have been deducted, but the price of power to the consumer in the case of the privately owned companies, whether in the Province of Quebec or in the United States, has included such profits or dividends as may have resulted from the conduct of their business.

"Whatever may have been the high salaries paid for executives, or whatever may have been the profits or dividends accruing in the conduct of the business affairs of the companies, it is manifestly plain that inclusive of these the price of power to the consumer has been less. This makes it very apparent that a far higher order of organization and administration exists in private than in governmentally owned electric utilities."

"The revenue per kilowatt hour generated for the American Niagara power district, which is comparable with the Ontario power district, is 17 per cent less than that from the total operations of the Hydroelectric Power Commission and the municipal commissions for wholesale power delivered in the Canadian Niagara district. It is about 13 per cent less than that for all the electric utilities in that district, whether governmentally or privately owned." In other words, the report says that the average cost of retail power to people residing within the municipalities served by the Hydroelectric Power Commission is 4.45 mills per kilowatt hour, or 40 per cent higher than the average cost of power to people in the American district. In addition the report points out that the American-Niagara district has a capacity 65 per cent in excess of that in Canada for each 1,000 population, thus maintaining a greater reserve against interruption of service and resulting in more efficient and more continuous service.

In spite of the higher costs of generation and less advantageous transmission and distribution conditions, privately owned companies in California are shown to serve the public at an average cost of power 4 per cent lower than the cost to the people served by Ontario systems other than the Niagara system. In

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Quebec the report states that privately owned electric light and power companies serve the people of that Province at a cost 32 per cent, or approximately one-third less than the cost of similar service to residents of Ontario, and that the cost in Quebec is 27 per cent less than to even those consumers residing in the Canadian-Niagara district. In addition private companies in Quebec deliver 84 per cent more energy per capita than does the Hydroelectric Power Commission to its customers in Ontario, while the generating capacity available for Quebec is 89 per cent greater than that available upon the lines of the Hydroelectric Power Commission in Ontario.

In this connection the report states that "privately owned and operated companies in every case are delivering power to their customers at a considerably lower average cost per kilowatt hour than is the case for government electric utilities; that the number of kilowatt hours generated per capita served is greater and that the number of customers taking service for each 1,000 of population is greater; also that standing behind the privately owned service is a larger reserve equipment to insure continuity of service."

With respect to the question of taxation, the report cites the fact that all property held by the Government electric utilities in Ontario is tax free with the exception of taxes upon land, so that taxation in Ontario is insignificant in so far as it affects the cost of power, but by the presentation of statistics it is shown that this does not make for a reduction of the cost of power to the people, but merely amounts to a redistribution of an equal amount of money which is collected from all the people of the community instead of only from those using power. On the other hand, taxes received from the principal private companies in the Province of Ontario amount to 7.1 per cent of their annual incomes, and in the Province of Quebec, this tax is 6.53 per cent of the annual revenues, while in the Niagara district of the United States taxes amount to 10.6 per cent, and in California to 7.7 per cent of the annual revenues.

It is asserted in the report that the erection of the huge hydroelectric station at Queenstown below Niagara Falls, which, when completed, will be the largest in the world, is not to the economic interest of the people of Canada.

When the Queenstown plant was started, it was expected that power would be developed very cheaply because of the fact that the full drop of the water from Lake Erie to Lake Ontario would be utilized, thereby enabling the turbines in the Queenstown station to develop twice as much horsepower per cubic foot of water per second as is developed by the turbines of those stations located at Niagara Falls. In spite of this immense advantage the report states that because of the enormous cost of constructing the Chippewa-Queenstown system the Hydro-Electric Power Commission can not produce electricity there as cheaply as it is produced in the less efficient plants. The report shows that although the commission was able to purchase from the Ontario Power Co. 100,000 horsepower for $9 per horsepower year, it will cost the commission $31.10 to produce each horsepower year of electrical energy at the Chippewa-Queenstown development, and that even then there is some question whether under the existing international treaty, sufficient water is available to permit the use of all units eventually to be installed at Queenstown. Should this deficit of water power be found to be actual and not merely apparent, the cost per horsepower year will be materially increased.

Dominion Government statistics which are cited in the report show that the cost of power to the people of the Province of Quebec is less than that to the people of Ontario. The revenue per dollar of salary paid employees of electric light and power plants is almost 32.5 per cent greater in Quebec than in Ontario, and the revenue per employee earned by private electric companies in Ontario is 31.5 per cent greater than that earned from the government-owned utilities, whereas the revenue per employee earned in the Province of Quebec is 42 per cent greater than that for the governmentally-owned and operated properties of Ontario.

During 1920, states the report, the average cost of power delivered to consumers in Toronto from the local hydroelectric power system was 29 per cent greater than that to the people of Montreal, and 25 per cent greater than to the people of Buffalo. The increase in the average cost of electricity in the several cities, which was brought about by the increase in cost of labor and material since 1917, has been 25 per cent for Montreal, 27 per cent for Buffalo and 44 per cent for Toronto. In connection with the operations of the Hydroelectric Power Commission and those of the municipalities in Ontario the capital addition in per cent of revenue, according to Mr. Murray, is greater by

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200 per cent than that for the American companies in the Niagara district, and by 350 per cent than that for the Quebec companies.

Further detailed data contrasting American rates with those that obtain in Ontario shows, in the opinion of Messrs. Murray and Flood, that the rate structure of the Hydroelectric Power Commission is fundamentally wrong in that it functions only to specific points in the Provinces where power is available at minimum cost, and that the American method of equalizing rates throughout the area eliminates premium on location, brings about decentralization, and offers better opportunity for industrial expansion and for healthier interstate and intrastate relations.

The report points out that the borrowing of the Hydroelectric Power Commission of Ontario, and the guaranties of the securities issued by the commission, form a large part of the Province's total liabilities, both direct and indirect. Approximately 70 per cent of the total liabilities of the Provincial Government of Ontario comprise investments for electric utilities. The investments made by the Hydroelectric Power Commission on behalf of the municipalities at the end of the fiscal year of 1920 totaled $51,514,183. The investments made by the municipalities on their own behalf total $26,172,894. The investments made by the Province total $11,036,229. The investment of all the governmental agencies in electric utilities in the Province of Ontario at the end of the fiscal year of 1920 was $121,232,011, or $48 per capita, indicating to what extent both the provincial and municipal governments in Ontario are interested in the business of generating and distributing electricity, rather than with the direct functions of Government.

The CHAIRMAN. Let me ask you this: Is it true that on the Canadian side the development is made by municipalities instead of by corporations?

Mr. MARTIN. Partly. There the policy was to vary the rates with the distance of transmission. As the distance increases the rate increases. In the system which we operate in Alabama there is no difference in our rate at any point. In that way is equalized the advantages among communities. One community would have a great advantage over another in the matter of hydroelectric development if one community had one rate and another community had another rate.

The CHAIRMAN. You operate it like the postal system?

Mr. MARTIN. We are maintaining it on that system at present. Sooner or later, as we extend it hundreds of miles, possibly beyond the State, we can not, of course, maintain that basis. There is a limit to which that can be maintained.

The CHAIRMAN. A system of that kind can only be maintained, comparatively speaking, in a small radius?

Mr. MARTIN. The radius in which we operate is now about 25,000 square miles.

Senator HARRISON. Does the Public Utilities Commission of Alabama have jurisdiction over your rates?

Mr. MARTIN. Yes, sir.

Senator HARRISON. Have you had any controversies with them over your rates?

Mr. MARTIN. Well, we have had some. Every now and then we have controversies. That is what the commission exists for—to try to adjust the differences.

In response to a question asked by Senator Heflin yesterday, I have obtained the lighting rates charged to the public by municipalities owning lighting systems in Alabama where power is furnished those municipalities for distribution by the Alabama Power Co.

In those five communities which I have mentioned the average rate they paid the Alabama Power Co. is 1½ cents per kilowatt hour, and their rates per kilowatt hour are: Opelika, 12 cents; Lafayette, 15 cents; Piedmont, 15 cents; Auburn, 15 cents; Sylacauga, 13 cents.

The Alabama Power Co. supplies lighting service direct to the public in 36 cities and towns in Alabama. The highest lighting rate is 9 cents per kilowatt hour.

Senator HEFLIN. Why does Lafayette, 18 miles from Opelika, have to pay 3 cents more per kilowatt hour than Opelika?

Mr. MARTIN. Well, I can not tell you, Senator.

The CHAIRMAN. You are speaking, Senator, of the consumers located there?

Senator HEFLIN. Yes.

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The CHAIRMAN. Of course, the municipality, I suppose, fixes the rate, and in one case it is 15 and in another one 13 and another 12.

Mr. MARTIN. Those municipalities own their own distribution systems.

Senator HEFLIN. I understand.

Mr. MARTIN. Opelika has a population of about 10,000.

The CHAIRMAN. They are paying 12 cents?

Mr. MARTIN. Yes, sir.

The CHAIRMAN. And they buy from you at 1½ cents?

Mr. MARTIN. Not to exceed 1½ cents. Of course you must bear in mind these communities must maintain their systems, and they have a limited radius in which they distribute, and their consumers are limited.

The CHAIRMAN. Exactly, but in a town of 10,000 people the consumers will be limited only by the population unless they charge fabulous prices, which they seem to have done there. They may charge so much that they won't have any consumers.

Senator LADD. How long has Opelika been using power from your company?

Mr. MARTIN. About five or six years.

Senator HEFLIN. Lafayette has been using it for about two years?

Mr. MARTIN. No, sir; Lafayette only a few months. I obtained these rates by telegraph on yesterday in response to questions by the committee.

You understand, Senator, at Buffalo there is a steam plant erected a few years ago at a cost of $10,000,000 in order to supplement the hydroelectric service. The hydroelectric power available has been absorbed entirely by industries which might be classed as private users of power. The question has become so serious in New York State that the governor, in his message to the legislature on January 24, 1922, made this recommendation:

"The State should grant licenses for the development of power for the general distribution, not for private use. With a general distribution assured, with the power to fix rates and to regulate service, capitalization, and secured debts of the licensee safeguarded, the maximum public benefit from the development of the potential water power within the State will unquestionably be secured through private enterprise."

That was the result of the experience of the grant of licenses for private use at Niagara Falls.

Senator HARRISON. Well, during the war it is my recollection we gave 4,400 cubic feet per second additional—I do not know how much horsepower—to be utilized as much as possible for war industries, so called. That is my recollection. There may be some controversy now that others should have the power except those war industries.

Mr. MARTIN. I would like to place in the record the following excerpt from the bulletin of the Alabama Manufacturers' Association of April 1, 1922:

"*Muscle Shoals.*—Does Ford's offer for Muscle Shoals contemplate a distribution of power throughout the State of Alabama, or does it contemplate the use exclusively in Ford's industrial interests, confining it to North Alabama? This State's development depends upon industry's ability to operate as cheaply as any other State, and in the distribution of power it is decidedly to the people's interests that it be distributed through the State and not confined to any one section."

Senator HEFLIN. Mr. Chairman, on yesterday Mr. Martin stated that they had expended at the Muscle Shoals Dam about $500,000.

Congressman Wright, of Georgia, asked Mr. Martin this question:

"That property was acquired—that is, the site and the flowage rights—at an expense of about a half million dollars?

"Mr. MARTIN. We had expended about a half million dollars on No. 2 site."

I have here a copy of a letter from the North Alabama Abstract Co., Tuscumbia, Ala., dated April 7, 1922, signed by O. B. Clark, general manager, in which he says:

"This report shows that for the lands and rights conveyed by said company to the United States, the original owners thereof receive from the company or those who bought on behalf of said company, the following amounts:"

Then he gives the amounts, and then says, "Total for all, $23,501.50."

Now, I wanted to ask Mr. Martin what this other money was spent for. You said on yesterday, Mr. Martin, about $500,000 was spent. This Abstract Co. says about $23,501 was spent for land, etc., in Alabama.

Mr. MARTIN. I am aware, Senator, of the affidavit and statement to which you refer. It has been printed in the papers in an effort to discredit our company.

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It is obviously made without any knowledge of many of the facts and conditions which exist.

This property was acquired over a period of years from 1906 on to possibly 1914. Prior to 1912 the project was owned by citizens of Alabama who, having acquired the lands, expended many thousands of dollars in their effort to develop the project, and you will find numerous reports on this table, numerous plans bearing date prior to 1912, and which have been put into the official records and surveys and plans made by the Muscle Shoals Hydroelectric Power Co. and which, of course, represent an expenditure of a great many thousands of dollars. Those owners sold their properties and interests in 1912 to Mr. James Mitchell and associates and received from Mr. Mitchell cash and securities representing not only the original cost of those lands but the expenditures, and doubtless some profit, which those people had incurred over a period of the preceding years.

Since 1912 the Muscle Shoals Hydroelectric Power Co. has, through its officers, principally Mr. J. W. Worthington, spent many years in Washington in an effort to obtain congressional authority for development of that project. It has incurred other expenses, has employed engineers, made plans, borings, investigations, and various expenditures, both prior to and since 1912, which represented on our books at the time of the donation of this property, in February, 1918, approximately $476,000. It is, of course, obvious that an abstract company making a record from deeds filed of record had no access to records of this character, and it may also be true that deeds frequently cite one consideration when another is paid.

I think you will find $1 stated in some of those deeds.

I can only answer the statement in that way.

Senator HEFLIN. You could not give us an itemized statement, then, covering the amounts that go to make up that amount of $476,000?

Mr. MARTIN. I could only give it to you as I stated.

Senator LADD. Mr. Mitchell purchased those rights himself.

Mr. MARTIN. Yes, sir.

Senator LADD. What did he pay?

Mr. MARTIN. At that time my recollection is that the company had outstanding $252.000 in common stock. Mr. Mitchell purchased that common stock by paying cash and assuming other obligations representing that amount of money in 1912.

Senator HEFLIN. Mr. Chairman, at this juncture, I would like this entire letter from the North Alabama Abstract Co. to appear in the record, also a schedule of purchases of lands and flowage rights, and, if the committee would like, here are the two copies of deeds from the Alabama Power Co. to the Government. You might include them.

The CHAIRMAN. All right. Just hand them to the reporter.

(The letter, schedule, and deeds referred to are as follows:)

NORTH ALABAMA ABSTRACT CO.,
Tuscumbia, Ala., April 7, 1922.

Hon. C. W. ASHCRAFT,
Florence, Ala.

DEAR SIR: Re lands and flowage rights conveyed by Muscle Shoals Hydro-Electric Power Co. to the United States.

Complying with your request, we have examined the records of Colbert, Lauderdale, and Lawrence Counties, Ala., and herewith report to you the number of conveyances, dates, amounts paid, and the rights conveyed to and from the Muscle Shoals Hydro-Electric Power Co. in connection with Wilson Dam.

First. Attached hereto are copies of two deeds from Muscle Shoals Hydro-Electric Power Co. to the United States, both dated July 28, 1920. One conveys certain parcels of land including or adjacent to the site of Wilson Dam. The other conveys the right to overflow several tracts of land above the said dam.

Second. Also attached hereto is a schedule of purchases by or for the Muscle Shoals Hydro-Electric Power Co., with dates and amounts paid, as stated in the deeds.

In the copies of the deeds from the company to the United States you will note we have placed numbers opposite each parcel of land or overflow right. Then in our schedule of purchases by or for the company we have numbered the items therein. This is for your convenience, and signifies that, for instance,

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parcel No. 1, as numbered in margin of the deeds, was bought, as stated in remark No. 1 in our schedule of purchases.

This report shows that for the lands and rights conveyed by said company to the United States the original owners thereof received from the company or those who bought on behalf of said company the following amounts:

Colbert County:		
Lands at dam site	$3,972.50	
Flowage rights	1,555.00	
		$5,527.50
Lauderdale County:		
Lands at dam site	2,064.00	
Flowage rights	15,150.00	
		17,214.00
Lawrence County:		
Flowage rights		760.00
Total for all		23,501.50

Yours truly,

O. B. CLARK, *General Manager.*

A SCHEDULE OF PURCHASES OF LANDS AND FLOWAGE RIGHTS.

Below are listed the conveyances to the Muscle Shoals Hydro-Electric Power Co., or those who bought on behalf of said company, covering lands at the site of Wilson Dam, in Colbert and Lauderdale Counties, Ala., and flowage rights above the dam site in Colbert, Lauderdale, and Lawrence Counties, Ala.

The numbers below refer to the numbers of description in the two deeds from said company to the United States, copies of which are attached hereto.

Lands at dam site:		
Colbert County—		
No. 1. Andrews, Malone, et al., 17.9 acres, Dec. 1, 1906		$447.50
No. 1. E. C. Sadler, 29.9 acres, Sept. 11, 1906		775.00
No. 2. E. C. Sadler, ———, May 7, 1914		2,750.00
Total		3,972.50
Lauderdale County—		
No. 3. A. D. Bellamy, 41.28 acres, Sept. 21, 1906		2,064.00
Total		6,036.50
Flowage rights above dam:		
Colbert County—		
No. 1, Henry Gargis, Oct. 2, 1906	$360.00	
No. 2, J. P. Hennigan, Sept. 16, 1907	10.00	
No. 3, B. H. Carter, Sept. 12, 1912	10.00	
No. 4, Carter heirs, Nov. 30, 1912	375.00	
No. 5, C. D. Carter, Sept. 13, 1912	350.00	
No. 6, R. W. Hennigan, Sept. 23, 1912	400.00	
No. 7, J. H. Brown, Sept. 20, 1907	50.00	
Total for flowage in Colbert County	1,555.00	
Lawrence County—		
No. 8, Charles McDonald, May 28, 1908	130.00	
No. 9, O. H. Bynum et al., Aug. 26, 1907	600.00	
No. 10, O. H. Bynum et al., Sept. 28, 1907	30.00	
Total for flowage in Lawrence County	760.00	
Lauderdale County—		
No. 11, Douglass & Jackson, May 7, 1914	150.00	
No. 12, F. E. Jackson, May 1, 1915	15,000.00	
Total in Lauderdale County	15,150.00	
Total paid for in rights and lands in this deed		17,465.00
Total for lands and rights in both deeds		23,501.50

Know all men by these presents, That the Muscle Shoals Hydroelectric Power Co., a corporation organized and existing under the laws of the State of Ala-

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bama, for and in consideration of the sum of one dollar ($1.00) to it in hand paid by the United States of America, the receipt whereof is hereby acknowledged, does hereby give, grant, bargain, sell and convey unto the said United States of America the following lands situated in the Counties of Colbert and Lauderdale, State of Alabama,—

The lands situated in Colbert County being described as follows, to-wit:

No. 1. A part of fractional section eighteen, township three south, range ten west of Huntsville principal meridian, more particularly described as follows, to-wit: Beginning at the northeast corner of said fractional section eighteen; running thence south along the section line for a distance of eight hundred (800) feet to a point; running thence southwesterly in a straight line for a distance of twenty-seven hundred ninety-seven and eight-tenths (2797.8) feet to a point eight hundred (800) feet from the south bank of the Tennessee River at low water mark; running thence north for a distance of eight hundred (800) feet to the south bank of the Tennessee River at low water mark; running thence along the south bank of the Tennessee River at low water mark to the point of beginning; containing forty-seven and eight-tenths (47.8) acres, more or less.

No. 2. Also a strip or parcel of land situated, lying, and being in fractional section eighteen, township three south, range ten west of Huntsville principal meridian, described as follows, to wit: Beginning at the point of intersection of the section line between section thirteen, township three south, range eleven west, and section eighteen, township three south, range ten west, and the low-water mark of the Tennessee River; running thence south along the section line for a distance of six hundred and thirty (630) feet to a point; running thence in a northeasterly direction to a point on the half-section line, said point being six hundred and thirty (630) feet south of the point of intersection of the half-section line and the low-water mark of the Tennessee River; running thence north along the half-section line for a distance of six hundred and thirty (630) feet to the point of intersection of the half-section line with the low-water mark of the Tennessee River; running thence along the low-water line of the Tennessee River in a southwesterly direction to the point of beginning, subject to the agreement relative to the houses and fences of said tract contained in the deed of Elizabeth C. Sadler and husband, W. H. Sadler, to Wiley Alford, bearing date of May 7, 1914, and recorded in the office of the Judge of Probate of Colbert County, Alabama, in volume 16 of deeds, page 551, and as modified by the agreement between Elizabeth C. Sadler and husband, W. H. Sadler, to Wiley Alford, bearing date of May 7, 1914, and recorded in the office of the judge of probate of Colbert County, Alabama, in volume 16 of deeds, page 551, and as modified by the agreement between Elizabeth C. Sadler and husband, W. H. Sadler, and Wiley Alford, bearing date of May 12, 1914, and recorded in the office of the judge of probate of Colbert County, Alabama, in volume 16 of deeds, page 552.

And the lands situated in Lauderdale County being described as follows, to wit:

No. 3. Fractional northwest quarter of the southeast quarter of section seven, and the fractional northeast quarter of the southeast quarter of said section seven, township three south, range ten west of Huntsville principal meridian, lying north of Tennessee River, and containing forty-one and twenty-eight hundredths (41.28) acres, more or less.

To have and to hold the aforegranted premises, with all the rights, easements, and appurtenances thereunto belonging, to the said United States of America, its successors and assigns, forever.

In witness whereof the said grantor, Muscle Shoals Hydro-Electric Power Co., has caused this conveyance to be executed in its name and under its corporate seal by Thos. W. Martin, its president, and attested by Lamar Aldridge, its secretary, on this the 28th day of July, 1920.

[SEAL.] MUSCLE SHOALS HYDRO-ELECTRIC POWER CO.,
By THOS. W. MARTIN, *President.*

Attest:

LAMAR ALDRIDGE, *Secretary.*

STATE OF ALABAMA,
County of Jefferson:

I, W. R. Loyd, a notary public in and for said county, in said State, hereby certify that Thos. W. Martin, whose name as president of the Muscle Shoals Hydro-Electric Power Co., a corporation, is signed to the foregoing conveyance,

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and who is known to me, acknowledged before me on this day that, being informed of the contents of said conveyence, he, as such officer, and with full authority, executed the same voluntarily for and as the act of said corporation.

Given under my hand this 28th day of July, 1920.

[SEAL.]

W. R. LOYD,
Notary Public, Jefferson County, Alabama.

My commission expires June 21, 1921.

Know all men by these presents, That this identure, made and entered into this the 28th day of July, 1920, by and between the Muscle Shoals Hydroelectric Power Co., a corporation organized and existing under the laws of the State of Alabama, party of the first part, and the United States of America, party of the second part.

Witnesseth:

That the said party of the first part, for and in consideration of the sum of one dollar ($1.00), to it in hand paid by the party of the second part, the receipt whereof is hereby acknowledged, does hereby give, grant, bargain, sell, and convey under the said party of the second part, the United States of America, the perpetual right and easement to permanently overflow, by means of the construction, maintenance, and operation of the Wilson Dam across the Tennessee River, that part of the following-described lands in the counties of Colbert, Lawrence, and Lauderdale, State of Alabama, lying and being below the 505-foot contour, as referred to the precise level survey made by the United States engineers in 1895, as described in the report of the Chief of Engineers, United States Army, for the year ending June 30, 1896, and which 505-foot contour was actually staked out on the ground by the survey made by the United States engineers in 1919 under the direction of D. A. Watt, assistant engineer—

The lands lying and being in Colbert County, State of Alabama, being described as follows, to wit:

No. 1. All of the fractional southeast quarter of fractional section 6, township 3 south, range 9 west, of Huntsville principal meridian, lying south of Tennessee River.

No. 2. Also that certain strip or parcel of land lying along the south bank of the Tennessee River in fractional northwest quarter of northwest quarter of fractional section 8 and in fractional southwest quarter of southwest quarter of fractional section 5, township 3 south, range 9 west, of Huntsville principal meridian, which would be submerged if the level of the water of the Tennessee River should be raised to an elevation of sixty (60) feet above low-water mark.

No. 3. Also that certain strip or parcel of land lying along the south bank of the Tennessee River in the fractional east half of the northwest quarter of fractional section 8, township 3 south, range 9 west, of Huntsville principal meridian, which would be submerged if the level of the water of the Tennessee River should be raised to an elevation of sixty (60) feet above low-water mark.

No. 4. Also that certain strip or parcel of land lying along the south bank of the Tennessee River in fractional sections eight and nine, township three south, range nine west, of Huntsville principal meridian, which would be submerged if the level of the water of the Tennessee River should be raised to an elevation of sixty (60) feet above low-water mark. Said strip or parcel of land to include the entire frontage on the south bank of said river, lying and being in the following-described tract of land, to wit: Beginning at a point nine hundred seventy-three and five-tenths (973.5) feet west of the northeast corner of the southeast quarter of the southwest quarter of said fractional section nine; running thence north to the Tennessee River at low-water mark; running thence in a westerly direction along the south bank of the Tennessee River at low-water mark to the northeast corner of the lands claimed by and in possession of W. H. Gargis on the 30th day of November, 1918, in said fractional section eight; running thence south to the northern boundary of the southeast quarter of southeast quarter of said fractional section eight; running thence east to the point of beginning.

No. 5. Also that certain strip or parcel of land lying along the south bank of the Tennessee River in fractional northeast quarter and north half of southeast quarter of fractional section nine, township three south, range nine

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west, of Huntsville principal meridian, which would be submerged if the level of the water of the Tennessee River should be raised to an elevation of sixty (60) feet above low-water mark.

No. 6. Also that certain strip or parcel of land lying along the south bank of the Tennessee River in fractional section ten, township three south, range nine west, of Huntsville principal meridian, which would be submerged if the level of the water of the Tennessee River should be raised to an elevation of fifty (50) feet above low-water mark. And also the entire fractional southwest quarter of southwest quarter of fractional section eleven, township three south, range nine west, of Huntsville principal meridian, containing four (4) acres, more or less. Also all right, title, and interest of the grantor in and to the islands or towheads in the Tennessee River north of and contiguous to the above-described tract of land in said fractional sections ten and eleven.

No. 7. Also that certain strip or parcel of land lying along the south bank of the Tennessee River in fractional northeast quarter of northwest quarter of fractional section fourteen, township three south, range nine west, of Huntsville principal meridian, which would be submerged if the level of the water of the Tennessee River should be raised to an elevation of sixty (60) feet above low-water mark. Said strip or parcel of land to include the entire frontage on the south bank of said river lying in said fractional northeast quarter of northwest quarter of fractional section fourteen.

The lands lying in Lawrence County being described as follows, to wit:

No. 8. That certain strip or parcel of land lying along the south bank of the Tennessee River in fractional west half of fractional section seventeen, in township three south, range eight west, of Huntsville principal meridian, which would be submerged if the level of the waters of the Tennessee River should be raised to an elevation of twenty-five (25) feet above the low-water mark of said river. Said strip including the entire frontage on the south bank of said river which lies along the said fractional west half of fractional section seventeen.

No. 9. And that certain strip or parcel of land lying along the south bank of the Tennessee River and more particularly described as follows: Beginning at the point where the north and south section line between sections fifteen and sixteen intersect the low-water line of the said river; running thence down stream with the said low-water line for a distance of twenty-five hundred (2500) feet to the point of beginning; running thence south parallel with the east section line of said section sixteen for a distance of four hundred and fifty (450) feet to a point; running thence at right angles west for a distance of twenty-three hundred (2300) feet to the mouth of Poplar Spring Branch; running thence up the south bank of the said Tennessee River, with the low-water line, to the point of beginning, said strip or parcel of land lying and being in the north half of fractional section sixteen, township three south, range eight west of Huntsville principal meridian.

No. 10. Also that certain strip or parcel of land lying along the south bank of the Tennessee River in fractional northeast quarter of fractional section sixteen, township three south, range eight west, which would be submerged if the level of the water of the Tennessee River should be raised to an elevation of sixty (60) feet above low-water mark, said strip or parcel of land to include the entire frontage on the south bank of said river lying in said fractional northeast quarter of section sixteen, township three south, range eight west of Huntsville principal meridian.

The lands lying in Lauderdale County being described as follows, to wit:

No. 11. A tract or parcel of land containing three (3) acres, more or less, more particularly described as follows: Beginning at the northeast corner of the northwest quarter of section three, township three south, range nine west of Huntsville principal meridian; running thence south four (4) degrees, forty-five (45) minutes east along the half section line to the north bank of Muscle Shoals Canal, being the southeast corner of the desired tract. From this point of beginning run north four (4) degrees, forty-five (45) minutes west for a distance of three hundred and fifty (350) feet to a point; running thence south eighty-five (85) degrees fifteen (15) minutes west for a distance of four hundred and eighteen (418) feet to a point; running thence south four (4) degrees forty-five (45) minutes east to a point at the north bank of Muscle Shoals Canal; running thence along the north bank of said canal in an easterly direction to the point of beginning.

No. 12. Also a tract or parcel of land described as follows: All of the southeast quarter of fractional section four, township three south, range eight west

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of Huntsville principal meridian, except a part thereof containing three (3) acres, more or less, which was conveyed by F. E. Jackson to the United States of America by deed of date April 10, 1890, and also except a part thereof containing twenty (20) acres which was conveyed by said F. E. Jackson to the United States of America by deed of date September 3, 1891.

To have and to hold unto the party of the second part, the United States of America, its successors, and assigns, forever, together with the right to go upon the lands hereinbefore described from time to time as occasion may require and remove therefrom any timber and other natural growth and any obstructions, growths, accumulations, brush, trash, filth, and any other thing which in any way interferes with or tends to render inaccessible, unsafe, or unsanitary any part of the slack-water pool created by said dam, or the margin thereof, or any plant to be erected upon said lands, the granting or reserving the right, however, to remove the timber, minerals, buildings, and improvements therefrom and to use the said lands so far as may be done without interfering with the easement and rights hereby conveyed to the grantee.

In witness whereof, the said party of the first part, Muscle Shoals Hydro-Electric Power Co., has caused this conveyance to be executed in its name and under its corporate seal by Thos. W. Martin, its president, and attested by Lamar Aldridge, its secretary, on the day and year first above written.

MUSCLE SHOALS HYDRO-ELECTRIC POWER CO.,
By THOS. W. MARTIN, *President*.

Attest:
LAMAR ALDRIDGE,
Secretary.

STATE OF ALABAMA,
County of Jefferson:

I, W. R. Loyd, a notary public in and for said county in said State, hereby certify that Thos. W. Martin, whose name as president of the Muscle Shoals Hydro-Electric Power Co., a corporation, is signed to the foregoing conveyance, and who is known to me, acknowledged before me on this day that, being informed of the contents of said conveyance, he, as such officer and with full authority, executed the same voluntarily for and as the act of said corporation.

Given under my hand and seal this 28th day of July, 1920.

W. R. LOYD,
Notary Public, Jefferson County, Ala.

My commission expires June 21, 1921.

Mr. MARTIN. May I see those?

Senator HEFLIN. Certainly.

Mr. MARTIN. Of course, in addition to what I have stated the company employed counsel, attorneys, in connection with this project at Muscle Shoals for many years, and there were abstracts of title and attorneys fees.

The CHAIRMAN. I think it ought to be said, probably, that if we were passing on the offer of this evidence in court, upon a technicality, it would probably be all ruled out. It does not go to the establishment of any point that is really at issue. But on the moral side of the question of the Alabama Power Co. in its intentions and dealings with the Government, it has a bearing, and I think we ought to put it all in.

Mr. MARTIN. On the question as to how far a statement of that kind is——

The CHAIRMAN. As to the question as to what we ought to do with Muscle Shoals, or whose proposition we ought to accept. I don't suppose, as a matter of law, it makes any difference how much it cost the Government to acquire the property that it got from the power company, or whether the power company gave them something for nothing, or whether they charged too much.

Mr. MARTIN. As a matter of fact, as I have stated, the power company received $1 from the Government for the property, and the whole purpose of this, as I see it, is to cast doubt on the statement we make as to the amount of money we spent on that property.

The CHAIRMAN. The copies of the deeds and the other evidence offered by Senator Heflin are admissible to the same extent and in the same way that your evidence is as to what you expended on that property, that you turned over to the Government for $1. You say it cost you $500,000. Both offers are on the same basis exactly. We ought not to admit one without admitting the other.

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Senator HEFLIN. Some Alabama citizens at Muscle Shoals have disputed the proposition that $500,000 has been expended there. It is perfectly proper for Mr. Martin to contend that they have expended it, and they have the right to refute it, if they can.

The CHAIRMAN. If it were a material proposition I would want to go into it in detail, but, as I said before, I don't think it is a material proposition.

Mr. MARTIN. Mr. Chairman, we have, in this whole situation here, presented it with a view of showing that we have at all times endeavored to cooperate with the Government, beginning with the time the present owners came in touch with this matter, in 1912, and from then on down to the present time. We have endeavored to cooperate with the Government as far as we could in dealing with this question. Prior to that time it was in charge of local citizens entirely, of whom Mr. J. W. Worthington was one of the principals since 1912, and up to February, 1920, Mr. Worthington was the president of this Muscle Shoals Hydro-electric Power Co. until a little over two years ago. This entire history, first and last, has been with a desire on our part to fully cooperate in every movement that the Government desired in this matter, and there was no delay or hesitation in 1918, when the Senators from Alabama, Senator Bankhead and Senator Underwood, asked us to cooperate with the Government by developing property, which we agreed to do. That we expressed in our letter to the Chief of Engineers under date of May, 1921.

The CHAIRMAN. Is that all?

Mr. MARTIN. That is all, Mr. Chairman. I had one other witness who was coming here to-day, but he has not come, and I would like to have him appear in the morning.

(Whereupon at 11.40 a. m. the hearing was adjourned to 10.30 a. m. Thursday, April 20, 1922.)

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MUSCLE SHOALS.

THURSDAY, APRIL 20, 1922.

UNITED STATES SENATE,
COMMITTEE ON AGRICULTURE AND FORESTRY,
Washington, D. C.

The committee met, pursuant to adjournment, at 10.30 o'clock a. m., in room 224 Senate Office Building, Senator George W. Norris (chairman) presiding.

Present: Senators Norris, McNary, Gooding, Ladd, Norbeck, Kendrick, Heflin, and Caraway.

The CHAIRMAN. The committee will come to order.

STATEMENT OF FRANCIS E. FROTHINGHAM, VICE PRESIDENT OF COFFIN & BURR (INC.).

The CHAIRMAN. Where do you live, Mr. Frothingham?

Mr. FROTHINGHAM. My home is in Boston.

The CHAIRMAN. What is your business?

Mr. FROTHINGHAM. I am a member of the firm of Coffin & Burr, who are investment bankers. My firm, as have I individually, has had wide experience all over this country and in Canada in connection with public-utility enterprises.

Mr. Martin wanted me to come here this morning to review this proposition from my point of view, which I shall be very glad to do.

It is always my effort, in studying these problems, to get at the facts as best I can and to draw such conclusions as the facts seem to warrant. It is most important always, of course, that any judgment should be based not on prejudice or any misunderstanding of the facts, if that can be avoided.

In Alabama there are opportunities for hydroelectric development of a very unusual kind. The reason for that is determined by nature.

The Allegheny Mountain Range, which parallels our Atlantic coast, is the source of the water-power streams that flow east into the Atlantic and west into the Ohio River, and that must for all time be the only available source of hydroelectric power in this part of the country. That the Allegheny Mountains run out into the lowlands in Alabama establishes the fact that the water-powers around the southwestern flank of the mountains must be the water-powers available for a very extensive country to the southwest and the west. The reason that that is so is simply a fact of nature that I would like to call your attention to.

The ancient shore of the Atlantic Ocean was far inland from where it is at present. That shore followed a line which connects the headwaters of navigation of the various streams that flow into the Atlantic Ocean and the Gulf of Mexico. For instance, the Savannah River is navigable to Augusta. Augusta was the old shore line. Macon, the headwaters of the Altamaha, I think, is another point on that line. The line then continues into Alabama, to Montgomery. The Alabama River is navigable from Montgomery to the Gulf. Then it turns north and goes up through Tuscaloosa and on through this Muscle Shoals section of the Tennessee River. Then the ancient seacoast line swung to the north and west, crossed the Mississippi River and returned to the Gulf somewhere west of the Mississippi River. That means that the entire areas on the sea side of that whole line is without water capacities. There may be minor powers here and there, but they are entirely inconsequential in connection with the proposition we are considering here.

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The CHAIRMAN. You mean in ancient times the Muscle Shoals was on the [illegible]?

Mr. FROTHINGHAM. Yes, sir.

The CHAIRMAN. And the Tennessee River emptied into the sea at Muscle Shoals?

Mr. FROTHINGHAM. At that point or thereabouts, Senator. That line swung around up north and came down west of the Mississippi. That means that the entire State of Mississippi, and the entire State of Louisiana, has no water power at all. Western Tennessee has no water power. Southeastern Arkansas has no water power. Eastern Texas has no water power. Oklahoma has very little water power. The only water power available in that territory is in northwestern Arkansas. That means that the water powers around the southwestern flank of the Allegheny Mountains are the only hydroelectric capacities which can send hydroelectric current into this entire area I have spoken of. If it is going to get hydroelectric power it must get it from these sources. There are, of course, as shown on the map there, large powers in Georgia and South Carolina, and on the other side of the mountains, in east Tennessee. But those capacities serve the localities to the north and northeast. To get into this territory I speak of they would have to cross over the capacities in northern Alabama.

The CHAIRMAN. In other words, these powers of which Muscle Shoals is a part are at least the nearest to this large area that has no water power?

Mr. FROTHINGHAM. They are the nearest.

The CHAIRMAN. That adds a great deal to the importance of the proposition?

Mr. FROTHINGHAM. Yes; naturally. Of course, hydroelectric power is more expensive as the distance to market increases. It is cheapest when the market is nearest the point of production. You want to ship it the least distance you can.

The CHAIRMAN. To follow that rule this is the natural supply for all that territory?

Mr. FROTHINGHAM. It is the natural supply. A radius of 300 miles from Birmingham includes New Orleans, Memphis, Lillte Rock, Ark., and Mobile. Memphis and Nashville are only 200 miles away. The entire State of Misissippi is practically within the 200-mile radius, and standard transmission practice to-day is 300 miles. In Southern California, I think, is the longest transmission we have now in the United States. Current is taken simetimes from the eastern side of the Sierra Mountains to Yuma, Ariz., about 470 miles. However, 300 miles is standard transmission practice, and that is being constantly extended. The result is, if we look at the map, that the cities of Mississippi—Vicksburg and the rest of them, New Orleans—any part of Misissippi or Louisiana, to get hydroelectric power, has got to reach out to these sources.

That means that it is of the utmost importance that these sources shall be so developed and coordinated as to give the maximum possible service. All of the history of hydroelectric experience has gone to show that hydroelectric capacities must be interconnected and interrelated in the most intimate possible way in order to get the greatest advantage from each one. The object of that is to take advantage of what is called the diversity factor. This can only be done by this coordination. By that I mean that the aggregate of all the power demands coming at a given time is less than the sum of maximum individual demands, so that you have not got to have so large an investment for power-producing capacity to take care of the aggregate momentary demands as you would have in taikng care of them in an individual way. Thus coordination enables one capacity which has shortcomings, to be readily offset by other capacities which have particular advantages. It means that the distribution of current may be made by the shortest distance from the point of generation to the point of consumption, all of which means economies and the conservation of expenditure for distribution capacities to reach extended markets.

The war, during which emergency it was important to get immediately as much power as possible, taught us that the first thing to be done was to interconnect systems so ,that different hydroelectric capacities would play together and offset one another, so as to get the advantage of this diversity factor, and this surplus from——

The CHAIRMAN. I suppose it would be on the same principle as a bank which has deposits from a whole lot of people, on the theory that they will not all want it at the same time.

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Mr. FROTHINGHAM. It is the same theory exactly. This diversity factor varies in different companies. In the case of southern California—Edison Co. in southern California—the connected load is two and one-half times the actual load that is put on the company. That is, if the connected load, adding up each separate customer, comes to 125,000 horsepower, a 50,000-horsepower station takes care of it.

In Alabama the load factor is slightly different. If the connected load is 100,000 horsepower, it will take 50,000-horsepower capacity to take care of it. If the investment was required to take care of each individual load separately, you would have to have an investment to make 100,000 horsepower.

It is to secure those economies that you need to have this intimate coordination. Particularly do I mention that because, as I see it, those points are not open to argument. They are matters of fact. If one does not allow for this coordination, if one does not build up a system which makes it possible with a minimum investment to get the maximum amount of current to the people of a territory, the only other physical way of supplying a given demand is to increase capacities; but, if you want to accomplish a given result most economically, those are the physical facts which control.

In Alabama there are three major power streams. One is the Tennessee, another is the Coosa, and another is the Tallapoosa River. Army engineers have collaborated with the engineers of the Alabama Power Co. for a great many years in studying the question of power development on the Tennessee River, with a view to taking advantage of its possibilities at Muscle Shoals. The Tennessee River is so flashy a stream—that is, its variations of stream flow from minimum to maximum are so great and so sudden—that it is a difficult river to control in order to get its full capacity into use. The minimum flow of the stream is about 7,000 second-feet. By second-feet I mean the number of cubic feet that flow by a given point in a second. The minimum flow of the river at Wilson Dam would produce 70,000 to 75,000 continuous horsepower. It can produce no more continuous horsepower. The average flow in a series of years will produce about 125,000 horsepower. That, again, is a physical fact that we must accept. In other words, the power that is available all the year around is only about 125,000 horsepower.

The question then comes how the Tennessee River can be supplemented in order that the power that is available less than all the time may be made available all the time. That can only be done by some sort of relay capacity, either steam to make good the times when the river is low, or water-power capacities from some other source.

Senator MCNARY. Could that be tied to storage in other streams?

Mr. FROTHINGHAM. That I was going to say. Please do not hesitate to interrupt me at any moment to ask questions.

The Tallapoosa River and Coosa River are especially valuable for storage. It is the opinion of the Alabama Power Co.'s engineers, as well as of the Army engineers, that the most practical way of getting this relay power to help out the low flow periods of the Tennessee River is by the development of storage on the Tallapoosa and Coosa Rivers, and in connection with that storage and at other points hydroelectric capacities on those streams.

Senator MCNARY. Where is the Tallapoosa River? Is it shown on this map here at all?

Mr. FROTHINGHAM. The Tallapoosa River is down in the eastern part of the State and flows into the Alabama River just north of Montgomery.

The CHAIRMAN. It is on the other side of what we call the divide. The waters of the Tallapoosa go into the Gulf of Mexico and not into the Tennessee?

Senator HEFLIN. The Tallapoosa and the Coosa Rivers make up the Alabama, 14 miles above Montgomery.

Senator MCNARY. It is not a part of the watershed of the Tennessee River?

Mr. FROTHINGHAM. No, sir. In connection with hydroelectric development it is very important that wherever different watershed areas can be tied together they should be, because no two watersheds have the same characteristics of rainfall, run-off, and so on.

The CHAIRMAN. I can see how that would be important. When you would have low waters in the Tennessee watersheds you may have high waters in the other watersheds, so they could help each other there.

Mr. FROTHINGHAM. That is very well illustrated in the northern districts where streams derive their waters from the melting snows and the run-off comes later than on a stream farther south.

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In the same way, take the Allegheny range. You may have in northeastern Tennessee conditions which are altogether different from those down in Alabama. By tying them together you take advantage of that particular kind of diversity factor.

Now, it was decided by the Government engineers—I say decided, because it is embodied in a report made and presented to Congress for the development of Muscle Shoals by the Government engineers—that the best and most practical way of making the power available at Muscle Shoals to its maximum was to coordinate it with the resources of the Coosa and Tallapoosa Rivers. The distances are comparatively small. Muscle Shoals to Montgomery, if I am not mistaken, is about 175 miles, which is nothing for a transmission line. A radius from Birmingham, of the distance from Birmingham to Muscle Shoals, would include all these possibilities that I speak of. You would have within such a circle a possible hydroelectric installation of a million and a half horsepower. Of course, I do not mean power that is available all the time, because installations are not made in that way. The major public demand is for 12 hours. The other 12 hours the demands are much less. So that means installed capacities on what is called a 50 per cent load factor basis. Of an interconnected aggregate such as I have mentioned the Wilson Dam would be developed probably to 500,000 to 600,000 horsepower. That would mean that that development would give its capacity during certain periods of the year, and when it did not give them it would be supplemented by power from other watersheds.

This plan that I speak of does not involve regulation of the Tennessee River. On the Tennessee River itself there are various reservoir possibilities and dam sites. As those reservoirs are developed they would help the flow of the Tennessee River, and in so far as they do they would improve the situation at Muscle Shoals and help the whole situation, of course. But the opportunities in Alabama are so much nearer and can be coordinated so much more quickly that their effect would be secured a great deal sooner.

Senator McNARY. That would contemplate dams in these two rivers?

Mr. FROTHINGHAM. Oh, yes. The Alabama Power Co. has the dam sites and is prepared to go ahead and make these developments whenever the market justifies that step being taken. Those steps will be progressive.

Senator HEFLIN. You already have a dam on the Tallapoosa now, have you not?

Mr. FROTHINGHAM. Yes; down near Montgomery. I don't think that dam is owned by the Alabama Power Co.

The CHAIRMAN. They have a dam in the Coosa River.

Senator HEFLIN. There are two high dams in the Tallapoosa River.

Senator McNARY. Do you contemplate more than one dam and one storage site on those rivers?

Mr. FROTHINGHAM. Yes, sir. The Coosa River is susceptible of progressive development at several sites. The company now has a development at Lock No. 12 and is making one at Duncan Riffle, and below that there is still another one possible, and on the Tallapoosa River there are two or three, and some opportunities in the upper reaches of the Coosa River. But the idea is that they would be developed progressively.

Senator McNARY. Have you an estimate of the storage in acre-feet?

Mr. FROTHINGHAM. Not in acre-feet; but, as I remember it, the storage capacity on the Tallapoosa River is 50,000,000,000 cubic feet. It is one of the very large artificial reservoirs in the country. I don't remember the capacities on the Coosa River, but they are considerable. The reason why the Coosa River reservoirs are particularly valuable is that they would be upstream of the developments on the Coosa River, so that all the stored water would be used over the lower dams.

Senator GOODING. These reservoir sites that you speak of, do they cover a settlement?

Mr. FROTHINGHAM. I believe not. There are no vested interests there, no investments; and, as I understand it, the ordinary farm values for the most part would be very low. That is as I understand the situation.

Senator McNARY. On that point, have you made estimates of the cost of the construction of storage sites?

Mr. FROTHINGHAM. There have been estimates made of all of these storage sites, but I do not recall them. I have not for a long time gone into the details. As developments are made the unit aggregate cost of installation shows a downward curve. That is, every new development reduces the cost of the investment per unit of capacity; and it is the expectation of everyone,

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of course, that as that process takes place it will be possible to give cheaper service.

The CHAIRMAN. The idea is that the improvement is to be made according to the demand for power.

Mr. FROTHINGHAM. Entirely so.

The CHAIRMAN. It would be a great many years before they would be required, and as they were developed the unit of power would be lessened in cost.

Mr. FROTHINGHAM. What I mean is this: That with 110,000 horsepower now installed at Lock No. 12, that represents a certain unit cost. For 220,000 horsepower the unit cost will be less than for 110,000 horsepower.

The CHAIRMAN. Yes.

Mr. FROTHINGHAM. As powers are developed it will mean a progressive lowering of the cost.

Senator GOODING. Your thought is that these water-power developments should be carried along together as nearly as possible, or should be considered together?

Mr. FROTHINGHAM. My thought is this, Senator, that if one is going to have in mind the manufacture of the largest amount of power at the minimum investment, that is the only way that it can be done. There are, of course, other factors; but if you are concerned with the question of producing the largest amount of power at the minimum cost, the highest quality of service that can reach the most extended area, I think there can be no dispute that this is the method; it is a matter of fact. That is the only way it can be accomplished. The Government engineers were so sure that that is so that before the war a plan was presented to Congress to develop Muscle Shoals——

Senator GOODING. This does not take into consideration, if we should go on with this greater development, you would not need the steam plants?

Mr. FROTHINGHAM. You would have to have some steam plants. There are no hydroelectric situations, with one or two exceptions, in the entire country that can be properly balanced without the support of steam-station relay. That is because you reach a time when it is economically less expensive to have a steam station to operate, whose investment cost is relatively low, so that while it stands idle interest will not eat you up, though when it operates it operates at a higher operating cost, than to have a high investment in hydroelectric plant stand idle, even though when it is run it is run at a lower cost of operation, lower cost per kilowatt hour. So that there is always an economic balance where you want a steam station to turn in in connection with hydroelectric capacities.

The CHAIRMAN. As I understand it, there never can be a development of power that steam would not help unless it was something like Niagara—absolutely the same the year around? Wherever you have a variation in the maximum and minimum flow you can help the situation by having a steam auxiliary plant?

Mr. FROTHINGHAM. Very materially. But don't let us even except Niagara. The reason we do not need steam to supplement Niagara now is that we are using only a part of its capacity. But suppose the wind blows from the east very hard—we will say for a week; it piles a lot of water in Lake Erie in the western end of it, and the flow of the Niagara River is lowered very much. Suppose you have a gale from the west. It blows the water of the lake nearer to the outlet, and the flow of the river goes up. So that you have got in the Niagara River considerable fluctuation, depending upon natural conditions. Furthermore, you may have an ice jam on the Niagara River that will make variations. So that if you were using the capacities of the Niagara River anywhere near their limit a steam plant should take care of that variation there. The only time, if I may digress a little—and pray do not let me say a word more or occupy your time an instant longer than you wish.

The CHAIRMAN. I think this is very interesting, myself.

Mr. FROTHINGHAM. The only time you do not need steam is when you are able to control the stream flow at a given point 100 per cent. Let me illustrate by taking the Bear River, out in Utah, north of Salt Lake City.

Senator GOODING. Out in Idaho. Bear Lake and Bear River are in Idaho.

Mr. FROTHINGHAM. Bear Lake is out in Idaho and Utah. Bear River flows into Bear Lake and Bear Lake is of such a size that it can take the entire flow of the Bear River, no matter how it comes, no matter what the floods are. The entire river is drawn into Bear Lake and held there, and can be let out of Bear Lake whenever you want it, and Bear Lake is of such size that it can hold the flow of Bear River for three or four years.

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The CHAIRMAN. That forms a reservoir site, then?

Mr. FROTHINGHAM. It forms a reservoir site. The result is you can hold the water in Bear Lake and let it out just exactly as you want it.

Those are not conditions which obtain here, or which can ever obtain here. The idea is to approximate them as clearly as possible, and that approximation is accomplished by intimate coordination. I can not repeat that too often, because it is so eternally true. The opportunities of coordination in Alabama are so much nearer, physically, and in time, as against what the upper reaches of the Tennessee River can accomplish, even when it is done, that it is, in the judgment of all the men who have studied it, the way to take advantage of the opportunity.

I believe if all these dams on the upper Tennessee River were made and this storage created, it would approximately double, for a period of about 90 days, the average low flow of the Tennessee River.

Senator KENDRICK. Do you believe that water could be stored in reservoirs at an expense that would justify the outlay?

Mr. FROTHINGHAM. There is no question about that, Senator. The studies which have been made all go to show that as these developments are progressively made the unit cost of production and distribution goes down, so that the more you do the cheaper you get your aggregate. Of course those are human estimates, and human judgment is fallable, but that is what the best study shows, that there is a progressive decrease in the aggregate cost of production and distribution.

Senator KENDRICK. The question was inspired by the impression I gained down in Muscle Shoals there, from our engineers, that while the water could be reservoired, it was questionable whether the benefit to be derived would justify the expense.

Mr. FROTHINGHAM. Whether the benefits would justify the expense, sir, depends altogether on whether or not they are made to meet a demand. If they are made in excess of the demand, of course they will not, but if the demand is there they will. That is one reason why nothing has been done on Muscle Shoals during all these years, because so large an initial investment was necessary before you could get your first bit of output, and unless you developed your market and developed the business to absorb the capacity of the Tennessee River, you would be economically unsound in going ahead.

For instance, take the Wilson Dam. You have to build the whole dam before you can get 5,000 kilowatts out of your power plant. Suppose your load is only 50,000 horsepower. You simply can not carry that cost. But now, when you have the business that has been built up by the Alabama Power Co., which has a demand at the present time for 170,000 horsepower, and by the time Wilson Dam could be completed, within three years, a demand sufficient to carry its cost, then you are justified in talking about development. And we have reached that time, in my opinion.

The plan which was made to Congress before the war involved the idea that the Government would pay the cost of development and the company would repay that cost over a period of years, in agreed upon amounts. The Government stands permanently the portion of the cost that applied to navigation, and the company the portion of the cost that applied to hydroelectric development. We had to go to Congress because there was at that time no water power bill. If the matter were up for discussion now, without complication by any work done during the war, this development of the whole Muscle Shoals situation would, as a matter of routine, be before the Water Power Commission and would be passed upon by the Water Power Commission after hearing, within the limitations of that bill. But as the result of the oncoming of the war, for emergency war purposes, it became necessary to do the work which was done there as rapidly as possible, and the Alabama Power Co. turned over to the Government its work and investigations, on which it had spent close to $500,000 at the Wilson Dam, for a mere dollar, because it wished to help the war situation, and the Government went ahead with it under special war legislation.

Now, I take it that we are not concerned with the special war legislation, because we have to have now special legislation to untangle the situation. The problem is rather what is the fundamental concern of the Government in this Muscle Shoals proposition and how can it best serve the aggregate need.

Now, as I see that, the Government is first concerned with power for the manufacture of explosives for its nitrate plant in time of war; second, if it should come to the conclusion that in time of peace it wants to use the nitrate

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plant to manufacture fertilizer, it wants to be sure there is power available for the manufacture of fertilizer.

Over and above those two demands, I take it, the concern of the Government is that the remainder of the power there potentially available shall be put to the greatest possible use of the greatest number of people; that is, that it shall be coordinated in the way that I have spoken of, so that it can reach Nashville, Memphis, Mobile, the cities of Mississippi, New Orleans, and supply the demand for electrical power in those centers. The question is what agency is the best agency to do that. To me it is clear that the Government ought not to undertake it. Our whole country has been built up by private initiative, and the time has not yet come when we can set aside the great advantages that can be gained from private initiative. But when private initiative reaches into the public service then I do not believe we can trust human nature enough to let it go on about its business without public control. And it is in that way that the supervision of these public services by commissions has been brought about, so that public services are entirely under the control of Government jurisdiction, a jurisdiction created by the people.

I am getting away from my point, but let me continue on for a moment.

Senator GOODING. That is a good point. Just develop it a little more.

Mr. FROTHINGHAM. If the Alabama Power Co.—and I mention the Alabama Power Co., which has had long technical experience in its field, it has got 1,500 miles of transmission line in northern Alabama, it has got distributing systems, it is serving some 750,000 people, it is reaching out to communities that had no current at all, and it gives to each one of those, as a result, not only power, but 24-hour power, so that if a small community has any natural advantages because of labor conditions or railroad facilities or anything of that nature, it can advertise cheap power, it can attract industry. It is only through the reaching out of such a system that farmers can have electric current to perform various farm services, like chopping corn for the silo, substituting electricity for the dangerous oil lamps in house and barn, thus lessening the menace from fire, for pumping water, and various services. It is only the big coordinated system which can reach out its tentacles in this way and reach everybody even at long distance. You can not do it otherwise.

The fear is that if you have the Alabama Power Co. or any other private agency perform such service, you are building up a monopoly against the public interest. Now, I think that is an entirely distorted point of view. When we think of monopoly we ordinarily think of some manufacturing concern that through various influences is able to exclude everybody else from manufacturing a particular product, and that can fix prices on its product at whatever the traffic will bear, and thus inflict injury on the public.

In the case of a public utility everything is reversed. A public utility is under public regulation. The Alabama Power Co. is either under the regulation of the utilities commission of Alabama or of Congress or of the Federal Water Power Commission. There is no twilight zone between those different controls. It is either under one or under the other. Whichever one it is under it is allowed to earn only a fair return—that fair return to be determined by the governmental jurisdiction—on the amount of money which has been expended in the public service, that amount to be determined by the public jurisdiction. That return anybody is entitled to. The result is not that the Alabama Power Co. is creating a monopoly against the public interest, but that the public is creating a monopoly in its own interest and for its own needs, determining only what agency shall perform that service for it; and if it allows the Alabama Power Co. to be the agency to do it, it takes advantage of private initiative and private energy, which, as I say, is at the background of the growth of this country. It takes advantage of that in its own interest, because it says how much money that private agency can earn.

Senator MCNARY. Would not that apply to all privately owned and operated utility plants, and is not that the situation that exists in every State in the Union?

Mr. FROTHINGHAM. It is. Not in every State, but in most of them. It is something that applies to public utility operations. I am distinguishing carefully between public utility operations, regulated, and the unregulated private operations.

Senator MCNARY. They are all doing a public service and are all regulated?

Mr. FROTHINGHAM. So far as public services are concerned; yes, sir.

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Senator McNARY. So it does not matter whether it is the Alabama Power Co. or Ford who operates the plant; it would all be subject to governmental regulation or State regulation?

Mr. FROTHINGHAM. But Mr. Ford has not put forward a proposition which would be subject to any regulation at all. Mr. Ford has put forward a proposal which would take these opportunities at Muscle Shoals and segregate them for private use for manufacturing purposes, not as a public utility, but as an unregulated private enterprise; and under those circumstances it is impossible that the potentialities of that situation can be coordinated in the way that I have spoken of, and put to the use that I have mentioned.

Senator McNARY. You are going upon the assumption that the contract would carry out the provisions for the manufacture of nitrates, and use as a fertilizer plant, except in time of war, and the balance of the power would be devoted to the manufacture of automobiles, or some private industry?

Mr. FROTHINGHAM. Whatever you choose, but unregulated.

Senator McNARY. That could not be regulated, of course.

Mr. FROTHINGHAM. It is unregulated. If a public utility makes the development and serves its customers, it must give service to all at nondiscriminatory prices, as Secretary Weeks has pointed out.

Senator McNARY. Oh, yes.

Mr. FROTHINGHAM. That is the great difference between those two propositions.

Now, I will just speak of one other point, sir, and I think I am done, except for such questions as you may want to ask.

Referring to this fundamental concern of the Government, first, the Alabama Power Co. offers to finish Wilson Dam at its own cost. It does not call upon the Government for any further expenditure. If that is done, under the Federal water power bill it accepts a 50-year license, with all the regulations of the bill. That is, the Federal Water Power Commission may require additional installations to be made. It is all under the control of the commission. Its rates are made to produce a return on the investment determined by the Public Service Commission of Alabama.

The company offers to give the second 100,000 horsepower available from the Wilson Dam to the Government free. The records show that the stream flow of the river is such that this 100,000 horsepower is available 82 per cent of the time.

Senator GOODING. How much?

Mr. FROTHINGHAM. Eighty-two per cent. That percentage, sir, is worked out by taking the Government records of stream flow which have been kept for a good many years.

Senator NORBECK. That allows enough water to go over the dam during low-water periods to maintain navigation, does it not?

Mr. FROTHINGHAM. The navigation is completely taken care of in all of these plans, as I understand it. There is no question there.

Senator KENDRICK. As I understand it, that 100,000 horsepower for 82 per cent of the time means an average, so that it would amount to more than that at one time and less at another, averaging 82 per cent of the time 100,000 horsepower.

Mr. FROTHINGHAM. The second 100,000 horsepower at the Wilson Dam, if you have full stream flow, would be available all of the time. The records show, over the past 40 years, I think, that it would be available on an average 82 per cent of the time.

Senator GOODING. The second 100,000 horsepower?

Mr. FROTHINGHAM. Yes, sir.

Senator NORBECK. What is the lowest it would be in any one year?

Mr. FROTHINGHAM. Well, I have told you that the minimum flow of the river as recorded is 75,000 horsepower. So that on the minimum stream flow of the river it may not be there at all.

Senator NORBECK. But if you take the average of 40 years, it will average 80 per cent?

Mr. FROTHINGHAM. I will not say it is just 40 years.

The CHAIRMAN. I think it is 50 years.

Senator NORBECK. In some particular years it might give power for 100 per cent of the time?

Mr. FROTHINGHAM. Yes, sir.

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Senator NORBECK. That is the maximum. What is the poorest year in the 40? How many days in the poorest year would it give 100,000 horsepower?

Mr. FROTHINGHAM. I can not tell you.

The CHAIRMAN. There would not be any year that they would be without power, but there would be days in the year when the Government, getting the second 100,000 horsepower, would not have anything.

Senator NORBECK. Might it not be a period of six months during some bad year?

The CHAIRMAN. Oh, no; not unless the records are different from what the 50 years measurements show.

Mr. FROTHINGHAM. The records do not show it.

The CHAIRMAN. There would be times that the person getting the first 100,000 would not get his full power and there would be some days that he would get more. I think on the average of 50 years, as I remember the testimony, there would be a day and a half in the year when there would be less than 87,000 horsepower. Is that right, Major Burns?

Major BURNS. Yes, sir.

The CHAIRMAN. On an average, based on gauge reading for 50 years, there would be a day and a half each year when the power development at that plant would be less than 87,000 horsepower.

Mr. FROTHINGHAM. Those are matters, of course, of estimate based on figures that are available.

The CHAIRMAN. What did you say would be the maximum production in horsepower at the Muscle Shoals Dam?

Mr. FROTHINGHAM. I do not think I stated it in that way. I said that if the Muscle Shoals Dam were built and coordinated with other available hydroelectric powers, that there would be installed, when you got it finally completed, perhaps——

The CHAIRMAN (interposing). Let me, for the benefit of the Senators who were not here when this testimony was given——

Senator HEFLIN (interposing). I would like to get this on the record, Mr. Chairman. That dam alone. How much horsepower would be produced at the Muscle Shoals Dam?

Mr. FROTHINGHAM. You mean standing alone, not coordinated with anything?

Senator HEFLIN. Yes, sir.

Mr. FROTHINGHAM. If that dam is built and completed as the river stands to-day the average minimum flow of the stream will produce about 125,000 continuous horsepower. If that power is used during 12 hours a day instead of 24 it would be 250,000 horsepower. That is what the river on the average low flow will do alone.

The CHAIRMAN. There are so many members of the committee here to-day that I think it would be well to call your attention to an extract from Colonel Barden's testimony right on this point of the development of power at the Wilson Dam.

These figures are based on accurate gauge readings covering 50 years:

Eighty-seven thousand three hundred horsepower available 99.4 per cent of the time; 100,000 horsepower would be available slightly more than 97 per cent of the time.

At lowest accurate gauge readings on the Florence gauge 71,900 horsepower would be developed, which is absolute primary. That would be, as I understand it, 100 per cent of the time—all the time.

Senator KENDRICK. That is the smallest flow of the river known in 50 years.

The CHAIRMAN. Yes.

Maximum installation contemplated at flood tide, 624,000 horsepower. Maximum would be greater by installation of additional machinery. One million one hundred and six thousand horsepower would be available 7 per cent of the time. Of course, as he says here, that is not commercially valuable.

Mr. FROTHINGHAM. Referring to the terms of the offer of the Alabama Power Co., the company would finish this dam under the water power bill, provide this second 100,000 horsepower, and the Government would be left with the ownership of the nitrate plant and quarry and with this 100,000 horsepower available 82 per cent of the time, with which to do as it sees fit.

Senator KENDRICK. May I ask a question?

I want to ask if the Government proposes to operate this nitrate plant, would it be good judgment and wisdom on the part of the Government to maintain

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the steam plant at the dam in order to reinforce this 100,000 secondary power at the dam?

Mr. FROTHINGHAM. My judgment would be no, for this reason, that if the Government retains the plant, the steam plant would stand idle this average of 82 per cent of the time.

Senator KENDRICK. It would not necessarily be idle. Could it not be leased to the Alabama Power Co.?

Mr. FROTHINGHAM. It probably could be, but if the Government is going to do that, why is it not better to let the Alabama Power Co. take the thing and operate it and coordinate it with its resources, and the Government not be responsible for the investment in it, or in any care or keep or maintenance of it, or any concern with it at all, but with it there available as a source of power for the Government when the Government wanted it this 18 per cent of the time, or for any other purposes. Not only that, but——

Senator KENDRICK (interposing). Just one more question.

Is it palpably certain that the Government, in operating the nitrate plant, would want to employ the steam plant only 18 per cent of the time?

Mr. FROTHINGHAM. I mentioned the 18 as the difference between 100 and 82. The stream flow records show that the water power would be available 82 per cent of the time. That being so, the steam plant would be needed only the other 18 per cent of the time.

Senator MCNARY. Is the 100,000 horsepower which is available 82 per cent of the time sufficient in capacity to produce 110,000 tons of nitrate of ammonia, as provided in the Ford offer?

Mr. FROTHINGHAM. Now we are getting on a subject that I do not profess to know much about. From my personal information I have no knowledge. I have understood, from what I have heard from others, that the power required to run nitrate plant No. 2 was from 90,000 to 100,000 horsepower. I have also understood that as a fertilizer proposition the product which the plant is now equipped to manufacture is not well adapted to fertilizer manufacture; that it is a dangerous material; that to manufacture fertilizer at this nitrate plant it would be necessary to make some additional expenditures at certain stages to change it to produce a fertilizer, I think, known as sulphate of ammonia.

The CHAIRMAN. I think it is conceded that the nitrate plant, to make fertilizer, would need additional machinery.

Mr. FROTHINGHAM. Yes, sir.

The CHAIRMAN. The process is the same whether you are going to make fertilizer or explosives, up to a certain point. When you get to that point, to make fertilizer, it branches off in another direction, and no machinery from that point on is provided. Is that right, Major Burns?

Major BURNS. That is right.

The CHAIRMAN. I would like, if you will permit me, to interrupt you there to ask Major Burns is this a dangerous proposition? Is there any danger in the operation of nitrate plant No. 2 for making fertilizer?

Major BURNS. Not in my judgment; no sir. When you get ammonia nitrate you have an explosive, and that has to be treated with proper care, when you come to make fertilizer. There is not much danger involved.

Mr. FROTHINGHAM. I was speaking about the product that the plant is now equipped to manufacture. The reason I spoke of that was that in Germany they make this same ammonium nitrate which the nitrate plant No. 2 makes. The farmer will not buy fertilizer till the demand presses him. In Opau, Germany, they manufactured this ammonium nitrate in large quantity. Ammonium nitrate has the property—it deliquesces, I think—when it is stored it hardens. When at Opau they came to remove this material they found it too hard to remove in the ordinary ways, and they finally resorted to an explosive method of breaking it up in order to ship it. They used some sort of explosive— don't know what—and they made some 16,000 explosions in it to break it up, preparatory to shipment. After making some 16,000 explosions, one explosion set the whole thing off.

Senator GOODING. That was a short time ago?

Mr. FROTHINGHAM. A short time ago in Opau, Germany. Major Burns will check me up, I am sure. I am speaking from hearsay. I understood that that was the same material which nitrate plant No. 2 is now designed to produce.

The CHAIRMAN. I think that is correct. I don't think Major Burns would give a report of the German explosion just exactly as you do, but it is true, as I got it from Major Burns, that some misfortune of that kind occurred over in Germany, as you say. We might ask Major Burns about it.

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Major BURNS. What Mr. Forthingham has said is exactly correct, that they were making fertilizer of ammonium nitrate and ammonium sulphate. They thought it was perfectly safe, and it is perfectly safe if you do not get the percentage of ammonium nitrate in the mixture too great—not in excess of 50 per cent. It so happened that in the course of their operations there was a concentration of the percentage of ammonium nitrate so that it got up to above 50 per cent, perhaps up to 60 or 70 per cent. Then when they exploded it, in order to break it down into small lumps and get it to the market, one of the charges of powder was put into this concentrated ammonium nitrate, and that went off as an explosion and set the whole mass off, causing a terrific explosion and destroying a great deal of property.

The CHAIRMAN. As I have understood heretofore in talking this same thing over with you, Major, you expressed the opinion that there was not any danger of such a thing occurring here at Muscle Shoals, and there was no use of it occurring if they used proper care.

Major BURNS. No, sir; I don't think so. Of course, when you are dealing with explosives you are very apt always to have trouble. If you treat them with proper respect you do not have any trouble. As I said before, if you are making ammonium nitrate you have something you have to handle with proper care.

The CHAIRMAN. Do you think in this plant down here, if we were going to make fertilizer out of that material, such a thing would be liable to occur?

Major BURNS. There would be nobody in America who would ever think of placing a charge of explosive in ammonium nitrate in order to get it into small particles to make it easily handled.

The CHAIRMAN. The point I am trying to get at, Major, is: If people would use ordinary care, is there any use of such a thing happening?

Major BURNS. I don't think so.

The CHAIRMAN. You can commit suicide, but it is not necessary to do it. A man can take poison, but he ought not to take it, and if he has good sense he won't do it.

Senator GOODING. Mr. Chairman, these human mistakes have always been made, and won't we continue to make them?

Mr. FROTHINGHAM. Ammonium nitrate is a dangerous ingredient. But what I was trying to point out was that the Government would then have its nitrate plants, have 100,000 horsepower for the production of explosives, and in addition to that it would have been instrumental in creating this great coordinated agency which I speak of, which in time of war it could absolutely use as it wants to for its own purposes.

When you come to the question of peace and the demand for fertilizers, it seems to me that the Government has rightly taken the position that if fertilizer can be manufactured profitably at this nitrate plant No. 2, Muscle Shoals should be available as a power-producing medium for it. The Alabama Power Co.'s proposition gives this 100,000 horsepower for the manufacture of fertilizer, so that the Government may either manufacture fertilizer itself, having this free power, or license the plant, or sell it with this free power to whomever it chooses, under whatever conditions or provisions it wants to provide, so that this plant is provided with power at no cost to operate for the manufacture of fertilizer. Thus, if anyone wants to manufacture fertilizer there for the benefit of the public, the farmers at large, they have the free power, and they can make such arrangements with the Government as the Government wants to make.

Then, lastly, with regard to the surplus potentiality, under coordination and development by some single agency, and I personally think the Alabama Power Co. is the agency, because it is there in the territory, knows the business, has studied it all these years, there will be made available as no other method can make them available the potentialities at Muscle Shoals to meet the increasing demands for current and power in all this region that I have spoken of.

I think, perhaps, some of these gentlemen were not here when I told you, Mr. Chairman, and may I repeat very briefly, that the ancient shore line of the Atlantic Ocean was way inland from where it is, and that determines physical conditions forever, so far as we humans are concerned. That ancient shore line is where these streams that flow off the Allegheny Mountains fall into the navigable regions of the rivers. That line goes through Columbia, S. C.; Augusta, Ga.; Macon, Ga.; Montgomery, Ala.; swings north through Tuscaloosa, through this Muscle Shoals region; then north and west across the Mississippi, down to the Gulf, way west of the Mississippi River. That means that for all time the

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southern part of Alabama, the entire State of Mississippi, the entire State of Louisiana, western Tennessee, the eastern part of Texas, the southeastern part of Arkansas, can have no hydroelectric power which does not come from this direction, and if you are going to make hydroelectric power in this region for Mobile, Memphis, Nashville, only 200 miles away, New Orleans and Little Rock 300 miles away, for all these communities, it has got to come from this source, and the Government, if it is going to be guided by the underlying need of the greatest number of people, will see to it that this great opportunity is coordinated most intimately with other opportunities in that region.

The CHAIRMAN. Your objection, as I take it, to the Ford offer, is that it does not present the possibility of coordination. Suppose Mr. Ford constructed a big plant somewhere in the vicinity of Muscle Shoals, and he wanted more power, could he not become one of the customers of the Alabama Power Co., or, if he had some power, could he not sell it to the Alabama Power Co., or could he not connect up his power plant with the distributing system of the Alabama Power Co., and thus coordinate it all?

Mr. FROTHINGHAM. That can be done, Mr. Chairman, but it has this very material drawback, that the operation as proposed by Mr. Ford is an unregulated operation. There is no supervision over the money he spends, the way he constructs, the way he develops his power. If he has power to sell he is not going to become a public utility, because he does not want to become subject to public regulation.

The CHAIRMAN. Would he not have to if he sold electricity?

Mr. FROTHINGHAM. No; as a private manufacturer he can make power and sell it——

The CHAIRMAN (interposing). For his own use, but could he manufacture it and sell it without coming under the jurisdiction of the Alabama Commission?

Mr. FROTHINGHAM. He could sell it to a private consumer, just as he may sell the product of his manufacturing plant.

The CHAIRMAN. Would it not be more profitable, and could he not get more money out of it for himself, if he hooked it up with the Alabama Power Co., if he sold it to them, because use by a private consumer would be subject to all the objections which you have made to existing conditions, without coordination.

Mr. FROTHINGHAM. He would undoubtedly try to sell his power. He would try to sell it to the Alabama Power Co. or sell it to such other customers as he could get without becoming a public utility and coming under regulation.

But I would like to point out there that while you can get coordination to an extent, you get it only to an extent, because it never yet has been possible for two parties to make a contract together so that each party is not interpreting that contract to protect his own side of it, and the possibility of complete coordination is not there. Suppose some question comes up that an additional amount of power is wanted. One party to the contract says, "You make the investment and I will buy the product." The other party says, "No; I don't like that arrangement. It is more logical that you make the investment and I buy the product." There is a dispute, and you fall between the two and the thing is not done in a way to achieve the maximum result with the least investment.

Now, Mr. Chairman——

Senator CARAWAY (interposing). Before you leave that statement, you made a statement a moment ago about the sources of power for this territory. Were you aware of the fact that available water-power sites in Arkansas alone would supply the territory around Memphis and in Mississippi? That is 50 to 100 miles nearer to it than this development.

Mr. FROTHINGHAM. I had never heard of that, and I should be very much surprised if it is so.

Senator CARAWAY. Some of the dams are being constructed now. The first permit under the water power bill was issued for construction of power dam on the White River, and the borings for the dam are completed, and the dam on the Red River is half completed. That will reach Memphis within 50 miles.

Mr. FROTHINGHAM. The drainage areas of any of the streams up in that part of the country, where there is a difference of level and fall are so comparatively small——

Senator CARAWAY. You are mistaken, because I have been all over it.

Mr. FROTHINGHAM. There is not that amount of power there, sir. I believe it is not possible that there should be so much power in that region, and I have studied it with some care.

Senator CARAWAY. You are just mistaken, sir.

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Mr. FROTHINGHAM. All right.

Senator HEFLIN. Mr. Chairman, before we get away from that, I do not think the witness is correct in his statement that if Mr. Ford should sell power for the purpose of operating machinery or for lighting up homes in the cities he would not be subject to the rules and regulations of the commission in our State. It would be covered under that law; there is no question about that. He could not sell in competition with the Alabama Power Co. and the Alabama Power Co. be subject to the rules and regulations and Mr. Ford not.

Mr. FROTHINGHAM. Mr. Chairman, I think the Senator misunderstood me. You may recall that I specifically stated selling to some private customer. In selling power to the homes of people and that sort of thing he would immediately come under the jurisdiction of the Alabama Commission. That, of course, would be so. He could not go out in competition with the Alabama Power Co. without securing from the commission of the State a certificate of convenience and necessity which the State requires shall be granted.

The CHAIRMAN. Would he not be in competition if he sold to a private consumer or any other kind of consumer? Some other manufacturer, for instance. Suppose I went down there and set up a factory to make something and bought my power of Mr. Ford. Would not the Alabama Power Commission regulate the price?

Mr. FROTHINGHAM. That is not considered, I think, Mr. Chairman, as a public utility operation.

The CHAIRMAN. If the Alabama law does not apply to it, then the Federal law does, it seems to me, because they are utilizing the power of a navigable stream there and are going to handle it and sell it without any restriction.

Mr. FROTHINGHAM. Yes; but we suppose that Mr. Ford's suggestion is accepted, and if it is handed over to him he gets it without regulation, and he has asked that he be free from regulation. If he has to run a transmission line across the country so that he needs a franchise for a transmission line right of way, or something of that sort, that brings him within public utility jurisdiction; but if he can get the power to a private consumer from his own land to the land of the private consumer, that becomes purely a private matter.

The CHAIRMAN. Unless there is something in his contract that gives him that exemption.

Senator HEFLIN. That would not exempt him from the operation of the law of Alabama. Even the Federal Government could not do so unless the Alabama Legislature did it specifically. It would not be exempt from the regulations under our State laws, under a Federal act.

Mr. FROTHINGHAM. I had assumed if the Muscle Shoals site were owned by Mr. Ford, and he wanted to sell a piece of land to Jones & Co. to come in and manufacture some product, and he builds a plant there and runs his transmission line across to Jones & Co., that would be a private operation beyond any jurisdiction.

"This seems to be recognized by paragraph 5 of the Alabama public utility act of 1920, which is as follows:

"'SEC. 5. *Limitations.*—None of the provisions of this act shall apply to the generation, transmission, or distribution of electricity, to the manufacture or distribution of gas, to the furnishing or distribution of water, or to the production, delivery, or furnishing of steam for heat or power by a producer who is not otherwise a utility, for the sole use of such producer, or for the use of tenants of such producer, nor shall they apply to any person not otherwise a utility who manufactures and supplies such products to a utility for its use or distribution without participation by such manufacturer in such use or distribution. When a person is engaged in business, a portion of which business is private business and a portion of which business is the business of a utility, the authority, powers, and jurisdiction of the commission conferred upon it by law shall not be deemed to apply to and shall not be exercised with respect to that portion of said business which is a private business.'"

The CHAIRMAN. If his contract with the Federal Government would permit him to do that.

Mr. FROTHINGHAM. When you come, Mr. Chairman, if I may emphasize this point again, because I think it is one we want to keep our minds close to, and I am very much interested in the public aspect of all this thing, to manufacture current, there has got to be a certain investment. You can not avoid it. Somebody has got to absorb that investment. There is a certain investment in plant, and it costs money to operate the plant. All those costs are there. They have got to be absorbed by somebody. They have got to be paid by

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somebody in some way or other. If it is not paid in the direct cost per kilowatt-hour of current, but that current is bought at less than what its costs are, the price is, nevertheless, included in the final price of the finished products which are manufactured. In some way or other, somehow or other, the fair cost of developing these services by whomever they are developed, has got to be paid by the public, and I am arguing for an agency to do this thing which is under complete public regulation and control, that spends its money under Government control and supervision, that receives as its return a fair rate of return upon its investment, which is determined by that governmental power, so that you are beyond any possibility of private initiative taking advantage of the situation for itself.

Senator CARAWAY. If you will pardon me, don't you think your two statements are rather at variance? First, the argument was that we get the benefit of private initiative, and your last statement is that the utility is under complete control and regulation?

Mr. FROTHINGHAM. I said that under public control of privately operated utilities you have the advantage of private initiative and energy, subject to the regulation of the Government. Mr. Vail, before he died, said that in his judgment any operation which could be directly performed by private interests was better so performed, thus——

Senator CARAWAY. I think there is no question about that.

Mr. FROTHINGHAM (continuing). Thus combining the potency of the sovereign with the initiative and interest of the subject. I am simply coordinating those two things. In Alabama there is required a certificate of convenience and necessity before anyone can compete with any public utility in Alabama in its business. Now, that is in the public interest.

Senator CARAWAY. In some way or another I doubt that, because we have had trouble in my own State. We had a company devoted to manufacturing power and electric energy, under the control of the commission. We had trouble with them in the matter of extension of transmission lines. They would not extend their lines 5 miles or 8 miles—I don't recall——

Mr. FROTHINGHAM. But is not that a public responsibility, sir?

Senator CARAWAY. It simply meant that some sections would get the benefit and others would not.

Mr. FROTHINGHAM. But it is under public jurisdiction and it is the public and not the private management that is to blame.

Senator CARAWAY. I think that competition ought to be permitted to have some sway. Now, you want a complete monopoly of electrical energy in that territory by the Alabama Power Co.?

Mr. FROTHINGHAM. I am not speaking about complete monopoly——

Senator CARAWAY. Is not that the purpose of the Alabama Power Co., to get monopoly of all the electrical energy in that part of Alabama?

Mr. FROTHINGHAM. I think I would not put it in that way, sir. The object of the Alabama Power Co., its aim, is to have the opportunity to go ahead and develop these resources, to coordinate them very carefully under public control, in order that it can continue to extend its service to an increasing number of people. Unless you shut out competition, sir; unless the Government shuts out competition in its own interest, there is very grave damage done. It is in the public interest, primarily, that the private agency be not subjected to unlimited competition. The public has determined in its own interest it will not submit to any duplication of power plants or transmission lines, or distributing systems which have got to be absorbed sooner or later, and the costs of which have got to be paid by the public, if one system can give them sufficient and adequate service at proper rates. Just as soon as a private agency can not do that, and another can prove that it can give better rates and service, then there is the public utilities commission to issue such a certificate of convenience and necessity, and your commission will not allow that competition unless it gets something for it. That puts this burden on private initiative, that private initiative, in order to continue to perform the services, must see to it that it gives better service than anybody else can. Otherwise the public authority will give the job to somebody else.

Senator CARAWAY. Now, we have that question in the District of Columbia. In our street car service here. In a hearing before the commissioners the street car company wanted to prevent the issuance of a license for a buss line unless they were permitted to operate the buss line. That is the tendency of monopoly, always to want everything. Their primary object is profit to themselves, and the public gets out of them whatever service they see fit to give.

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Mr. FROTHINGHAM. Under public regulation the utility is limited to an adequate return on the money actually used, and that is determined by the commission. I think it is very fair to say that we are all human, and no matter what the economic scheme is that is devised, it can, in instances, be misused. Mistakes can be made under it; troubles can be developed under it. But we have advantages on the whole from that method which holds the possibility of the best service to the greatest number of people, and my belief is, sincerely, as a result of long study, that the method of public regulation of privately operated utilities is the best way of getting that result at the present time. Unless there are some questions, Mr. Chairman, I am through.

The CHAIRMAN. Mr. Frothingham, have you given any consideration to the bill that I have introduced, that is pending now before the committee?

Mr. FROTHINGHAM. I have not, sir.

The CHAIRMAN. Then you are not prepared to comment on it?

Mr. FROTHINGHAM. No, sir.

The CHAIRMAN. Do any members of the committee want to ask any questions? If not, the committee will adjourn until 10.30 o'clock to-morrow morning.

(Whereupon at 12 o'clock noon the committee adjourned to 10.30 o'clock a. m., Friday, April 21, 1922.)

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MUSCLE SHOALS.

FRIDAY, APRIL 21, 1922.

UNITED STATES SENATE,
COMMITTEE ON AGRICULTURE AND FORESTRY,
Washington, D. C.

The committee met, pursuant to adjournment, at 10.30 o'clock a. m., in room 224, Senate Office Building, Senator George W. Norris (chairman) presiding.

Present: Senators Norris, Capper, Keyes, Gooding, Ladd, Kendrick, and Heflin.

The CHAIRMAN. The committee will come to order. We are ready to proceed with you, Senator Butler.

Mr. BUTLER. Mr. Engstrum would like to make a brief statement.

The CHAIRMAN. All right, Mr. Engstrum, we will be glad to hear you.

STATEMENT OF MR. FREDERICK E. ENGSTRUM, WASHINGTON, D. C.

Mr. ENGSTRUM. Mr. Chairman, for the purpose of having it appear in the record, I will state my name.

The CHAIRMAN. Yes.

Mr. ENGSTRUM. Frederick E. Engstrum; business, president of the Newport Shipbuilding Corporation.

I have been engaged in construction work, constructing and building all classes of structures from railroads to skyscrapers, ships, power plants, industrial plants, such as the American Trona potash plants in California, the American Beet Sugar Co.'s plants, portion of the Salt Lake Railway, Southern California Edison electric power plants, and am just completing a contract, finishing a contract, for 19 concrete ships for the Government, for the Quartermaster's Department.

The CHAIRMAN. Mr. Engstrum, it has not anything to do directly with this investigation, but that statement interests me very much. Just briefly I wish you would tell us something about those concrete ships.

Mr. ENGSTRUM. In 1918 I came to Washington to investigate contracts for building concrete ships. There was an appropriation made then of $50,000,000. The President had requested an appropriation of $50,000,000 for the Shipping Board to build concrete ships. I requested a contract from the Shipping Board, but the Shipping Board informed me that they had already selected their builders.

The CHAIRMAN. I did not expect you to go into any great detail, Mr. Engstrum, but just in a general way.

Mr. ENGSTRUM. I was just going to give the way in which these ships were started.

I submitted a proposal to the Quartermaster Department to substitute at that time concrete vessels in place of steel and wooden ships for the harbor and river service. These ships were of the smaller type, 130 feet in length, and was awarded a contract for nine of them, which we built and are in service, under first contract. They were equipped with heavy duty gas engines, twin screw.

The next contract, in the first part of 1920, followed for seven more 150-foot river and harbor vessels, one of them operating on the Potomac between here and Fort Washington.

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These smaller type vessels were used between the cities and posts of the Army for carrying the soldiers and supplies between the city and the posts, and in addition we built three concrete tankers to supply fuel. The 150-foot type of vessels are the most economical oil-burning vessels that are in service anywhere that I know of in the world to-day. They operate on 16 gallons of crude oil per hour at 13 miles of speed; a little over a gallon per mile for a 650-ton vessel, 1,000 horsepower, two 500 horsepower Diesel engines. The 300-foot oil tankers are fuel ships.

The CHAIRMAN. Are all those concrete vessels in service now?

Mr. ENGSTRUM. They are all allotted now. They have been laid up temporarily, part of them.

The CHAIRMAN. Have they all been a success?

Mr. ENGSTRUM. Yes; all of our construction has been an absolute success.

The CHAIRMAN. How many of them are there now in service that you have constructed?

Mr. ENGSTRUM. There are 19.

The CHAIRMAN. Nineteen?

Mr. ENGSTRUM. Nineteen; excepting the last, which is just going into service.

The CHAIRMAN. How large are the last 10?

Mr. ENGSTRUM. The last seven are 650 tons, similar to the one on the Potomac River.

The CHAIRMAN. Now, where are those vessels?

Mr. ENGSTRUM. Four of them are allotted on this coast; to Norfolk and Washington and New York and Wilmington, and one is going to San Francisco.

The CHAIRMAN. Are any of them engaged in river traffic?

Mr. ENGSTRUM. Yes, sir; in the Army service, for carrying supplies.

The CHAIRMAN. None of them has been used for general freight purposes?

Mr. ENGSTRUM. No, sir.

The CHAIRMAN. Are they suitable for that?

Mr. ENGSTRUM. They are for passenger and freight. They are day voyage. There are no cabins. They are for shallow water, and draw 9 feet.

Senator GOODING. Are they fit for all purposes; all water navigation?

Mr. ENGSTRUM. Yes, sir. They have been through very severe tests. This vessel here has driven through 8 inches of ice continuously during the heavy winter season, and the concrete hulls under the most severe tests have shown no cracks or deterioration whatsoever.

Senator GOODING. Have any of the vessels weathered any storms up to the present time in any way?

Mr. ENGSTRUM. Four of those vessels about a month ago broke loose from their moorings at the mouth of Cape Fear River, at Caswell, where they were sent for allocation, and they were driven out to sea without anyone on them. The currents and the winds brought them back around the Frying Pan Shoals at the mouth of Cape Fear River, at the Cape Fear Lighthouse. They were driven back into the breakers and pounded the shore in the breakers for 18 hours, and were rescued by tugs putting men aboard and starting up the engines, and taking them off under their own power, and were then brought back into the river.

The CHAIRMAN. Were they damaged?

Mr. ENGSTRUM. They were not damaged—only the rails. The wooden end rails were broken by collision with each other. The hulls were not damaged.

The CHAIRMAN. All right, Mr. Engstrum. We will go back now to your offer.

Mr. ENGSTRUM. I will, if you please, state some of my experience, Mr Chairman.

The CHAIRMAN. How old are you, Mr. Engstrum?

Mr. ENGSTRUM. Forty-seven. I have been engaged all my life in contract construction work. My father was in the business before me, and I was with him until he passed on. In offering my proposition on the Muscle Shoals, my attention was directed to this more than a year ago—a year ago last April. I sent an engineer to Muscle Shoals to make a report to me on conditions there. I think Mr. Ford submitted his proposal some six months afterward. After that I visited Muscle Shoals to verify my reports and prepare data with which to submit the offer, and later I visited the plant again.

In pointing out the principal features of my offer I should like to have Senator Butler make a statement. He is associated with me in this undertaking as counsel, and will be one of the directors of the corporation which I

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propose to form. If it is agreeable at this time, Mr. Chairman, I would like Senator Butler to be heard.

The CHAIRMAN. All right. Follow your own plan, Mr. Engstrum.

STATEMENT OF HON. MARION BUTLER, ATTORNEY FOR MR. FREDERICK E. ENGSTRUM.

Mr. BUTLER. Will it not be best at this time, Mr. Chairman, to have the proposal read into the record?

The CHAIRMAN. Yes. I presume the committee has read the proposal. I have. I have been studying it this morning. But it would be very proper, I think, to put it into the record. Perhaps it would be sufficient to print it in the record. But that is only a suggestion, Mr. Butler. You do as you please about it. We do not want to interfere with your presentation in any way.

Mr. BUTLER. Then I ask that the proposal go into the record. There are some typewritten amendments to the printed copy, which will be explained as I reach them; I would like the proposal to go into the record with those typewritten amendments.

The CHAIRMAN. Senator, let me ask you this: I have in my possession what is termed an amended proposal. Now, is that amended further?

Mr. BUTLER. Just those typewritten slips.

The CHAIRMAN. Are in addition to that?

Mr. BUTLER. Yes. I desire the complete proposal with amendments, including the typewritten slips, to go into the record.

The CHAIRMAN. You want the reporter to print this as amended, I suppose?

Mr. BUTLER. Yes; print it with the typewritten amendments in it as if they were printed in.

(The proposal, as amended, is in the following words and figures:)

PROPOSED AMENDED CONTRACT FOR COMPLETION AND LEASE OF MUSCLE SHOALS.

WAR DEPARTMENT,
Washington, February 24, 1922.

DEAR MR. SPEAKER. I inclose herewith an offer for the Muscle Shoals properties submitted by Frederick E. Engstrum which I think should be considered in connection with the investigation now being made by Congress.

JOHN W. WEEKS,
Secretary of War.

The SPEAKER OF THE HOUSE OF REPRESENTATIVES.

AMENDED FORM OF PROPOSED CONTRACT FOR COMPLETION AND LEASE OF MUSCLE SHOALS PROJECT BY FREDERICK E. ENGSTRUM.

[Omit the words struck through and insert the words printed in italic.]

1. *Parties.*—Memoranda of contract made this ——— day of ———, 1922, by and between the Government of the United States, party of the first part, and hereinafter referred to as the Government, and Frederick E. Engstrum, of the city of Washington, D. C., for and in behalf of a corporation to be formed by him to carry out the provisions of this contract and to be governed by a board of seven directors, one to be selected by the Secretary of War, one by the Secretary of Agriculture, and the remaining five by proponent, party of the second part, and hereinafter referred to as the lessee.

2. *Lease.*—The lessee hereby leases all the property—real, personal, or mixed—now owned or hereafter acquired by the Government in connection with or forming part of, or extension of the Muscle Shoals project, or any part or appurtenance thereof, excluding the steam plant, located at Gorgas, Ala., on the Warrior River, but including the transmission lines from said plant to Muscle Shoals for use at present location or elsewhere as will best serve the purposes of this lease. Said property is included or intended to be included in the maps, deeds, descriptions, invoices, lists, and schedules furnished to the lessee by the Government and receipted for, and such maps, deeds, descriptions, invoices, lists, and schedules, together with receipts for same, hereinafter referred to as the schedule, shall be a part of this agreement and shall bind both parties.

3. *Term.*—This lease is to continue in full force for a period of 50 years from date the lessee acquires possession of the property. The lessee shall return said property at the termination of this lease to the Government in good operating condition, subject to damage beyond fault or control of the lessee.

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4. *Plans and specifications.*—It is mutually agreed by both the Government and the lessee that, for and in consideration of the lease, construction, operation, rights, privileges, payments, and other considerations hereinafter mentioned or otherwise provided for in this agreement, that the lessee will construct Dam No. 2, power station, steam plant No. 2 to a capacity of 90,000 kilowatts and steam plant No. 1 to a capacity of 10,000 kilowatts and such other structures now under construction or agreed to be constructed at Muscle Shoals, on the Tennessee River, in the State of Alabama, and hereinafter referred to as the "property," as are set forth and described more particularly in the maps, plans, specifications, photographs, and other engineering data (hereinafter referred to as the plans), copies of which have been delivered to lessee and duly receipted for by lessee, and such plans thus receipted for are hereby made an essential part of this contract and are as binding on both parties as if they were fully set forth and written herein. When the Government shall require the construction of Dam No. 3, for which there are no complete engineering plans, the lessee agrees to build the same on plans and specifications to be prepared by the Government and on a location to be approved by the Government. Lessee also agrees to build, at dam No. 3, another nitrate plant, of the most improved process, by plans and specifications submitted to and approved by the Secretary of War and the Secretary of Agriculture, which plant shall have the same relative output capacity to the power to be generated at dam No. 3 as is the combined capacity of nitrate plants Nos. 1 and 2 to the power to be generated at dam No. 2, other dams, and nitrate plants which may be built to conform to the same terms: *Provided*, That if the Warrior Steam Plant is not included in this lease, then the Government's interest in the same shall be sold and the proceeds used to enlarge and equip steam plants No. 1 and No. 2 at Muscle Shoals and the balance of said proceeds shall be turned into the fund for financing the production of nitrates and fertilizers as described in paragraph 6.

5. *Locks or lifts.*—It is further agreed that the lessee will construct for the Government the locks or lifts for the purpose of maintaining navigation over the dam or dams to be constructed at Muscle Shoals.

6. *Manufacture of nitrates.*—When the two nitrate plants, now a part of the property, which plants have an estimated capacity of 120,000 tons of ammonium nitrate per annum, have been redesigned and reconstructed as herein provided to manufacture such nitrates as are needed for commercial fertilizers, fertilizer compounds or mixtures as approved by the Secretary of Agriculture, the lessee agrees to operate said plants under the following conditions:

As soon as adequate hydroelectric power, generated at dam No. 2 becomes available, lessee will commence to operate both plants and will continue such operation to the capacity they can be operated, after deducting operating expenses, from the receipts of the sale of:

(*a*) Nitrates and fertilizer compounds,

(*b*) Seventy-five per cent of all marketable by-products not required for the manufacture of nitrates or fertilizer compounds,

(*c*) Sixty-six and two-thirds per cent of all power generated in excess of that required to operate the plants, which is sold by lessee either to itself or to other parties, provided that the price at which power, if any, is sold to lessee is subject to approval by the Secretary of War; and including the fund from the sale of the steam plant provided for in paragraph 4.

(*d*) In the event said fund is not sufficient to operate said plants continuously lessee will contribute to said fund for said purpose 20 per cent of its gross receipts from sale of power while such conditions exist.

The term "operating expenses" as used herein shall be understood to include the necessary and legitimate expenses for the proper operation of the entire plant for the purposes set forth in this agreement, including maintenance, alteration, repairs, and replacements, but not including the salaries of officers, directors, general manager, supervising engineers, and counsel fees of the operating company, the lessee.

When additional dams and nitrate plants shall have been built they shall be operated by the lessee under the same terms, except that the percentage of receipts from the excess power sold from such dam or dams—which is to be turned into the fund for the operating of such plants or to be paid into the Treasury, as the case may be—shall be 75 per cent thereof instead of 66⅔ per cent of such power from Dam No. 2 (as provided in subparagraph (c) above), and shall be in addition thereto.

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7. *Alterations of nitrate plants.*—It is also agreed that the lessee will make such alterations, additions, or changes in the nitrate plants as may be required to produce the nitrates or other fertilizer compounds approved by the Secretary of Agriculture, and to be completed within the time required to produce hydro-electric power at Dam No. 2. After the plants have been put in operation under this lease the lessee shall make such additions or changes from time to time as may be necessary to produce the required fertilizer or fertilizer compounds approved by the Secretary of Agriculture, and such changes are to be made as an operating charge.

8. *Plans of alterations.*—It is agreed that the lessee will furnish the Secretary of War copies of the plans and specifications of the proposed changes to be made in the nitrate plants to fit them to produce the nitrates and fertilizer compounds approved by the Secretary of Agriculture. Such alterations are to be designed as to keep the nitrate plant No. 2 in condition to produce explosive compounds with the least delay and expense.

9. *Research.*—The lessee agrees to maintain and operate a research department in cooperation with the Agriculture Department of the Government for the purpose of developing the processes for the fixation of atmospheric nitrogen, the cost of research work to be charged to operating expenses of the plant.

10. *Construction.*—Lessee agrees to begin construction within a reasonable time after it is given possession of the property and to continue such construction in a diligent, business, and workman like manner until all construction work provided for under this contract shall be completed, according to terms herein set forth, within three years from the time of possession, reasonable extension of time to be granted for delays over which the lessee has no control.

11. *Changes.*—It is further agreed that at any time during the construction if, in the opinion of either party herein, the structures provided for in the plans have become, or are liable to become, weak, dangerous, uncertain, or inefficient they may request changes, extensions, or additions to be made in the plans for the purpose of increasing the strength, stability, duty, endurance, or efficiency of the dams, locks, power stations, or other structures to be built by lessee under provisions of this contract, such changes, extensions, or additions shall be submitted to the engineer representing the other party and to the surety company furnishing the bond of the lessee, and if such changes, extensions, or additions shall be approved by the engineer representing the other party and the surety company they are to become a part of this contract and become as binding on both parties and the bonds of the lessee as if originally written herein.

12. *Arbitration.*—It is also provided that, in event a request of either party for changes, extensions, or additions in the plans for any of the purposes set forth in the foregoing paragraph of this contract has been approved by the surety on the bond of the lessee, and has not been approved by the engineer representing the other party, then the questions of endurance or strength of such material or members as can be determined by physical test shall be submitted to the United States Bureau of Standards for final determination, and all questions as to the effect of the proposed changes, extensions, or additions upon the increase of strength, stability, duty, endurance, or efficiency of the dams, locks, power stations, or other structures to be built under this agreement, the palns for the changes as requested shall be submitted to the engineering faculty, or such members thereof who will undertake the work, of one or both of the following-named universities or schools of technology: Massachusetts Institute of Technology, Cambridge, Mass.; Cornell University, Ithaca, N. Y.; and the report of such faculty or faculities, if submitted to more than one, together with the report of the Bureau of Standards, shall be final; and if such report of the Bureau of Standards and faculties of technical schools, mentioned herein, show that the proposed changes, extensions, or additions will materially increase the strength, stability, duty, endurance, or efficiency of the structures affected by the changes, extensions, or additions, then such changes, extensions, or additions shall become a part of the working plans of this contract, the same as if they were originally written herein or had been approved by the engineers of both parties and the surety bond.

13. *Costs of tests.*—It is also understood and agreed that the cost of testing, consulting, or other expenses caused by the request for changes in the plans, as provided for, shall be a part of the construction cost provided herein.

14. *Representatives.*—It is understood and agreed that during the time of construction that both parties hereto shall designate an engineer to represent

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them on the work, and the acts of such engineer shall be binding as to the party designating him as a representative.

15. *Investment.*—It is agreed that the lessee will not be required to invest in the manufacture of nitrates or other fertilizer compounds any money, other than that received from the sources enumerated in paragraph 6. The lessee agrees, however, to advance all the money that may be necessary for "operating expenses" until sufficient funds are received from the sources enumerated in paragraph 6, the said money so advanced to be reimbursed as soon as practicable.

16. *Sale of products.*—It is further agreed that the lessee will sell all nitrates and fertilizer compounds produced by the plant at prices and on conditions and terms approved by the Secretary of Agriculture, and also will sell all by-products not required in the manufacture of fertilizer compounds, for which there is a market, and all excess power for which there is a market, it being understood and agreed that primary power may be sold and the nitrate plants may be operated by secondary power to the extent that the same can be done to assure the best financial returns for the operation of the plant and to produce a maximum of nitrates and fertilizers under this contract.

17. *Additional plants.*—It is further agreed that in event the development of power for use and sale from this plant, together with the receipts from the sale of products, should be insufficient to produce the amount of fertilizer compounds required to supply the demands, the lessee agrees to construct, under the terms of this agreement, other power plants or storage reservoirs upon sites owned by the Government and selected by the Secretary of War and itself, said plants or storage reservoirs to be constructed and operated under the general terms of this agreement for the purpose of enabling it to provide the fertilizer compounds to meet growing needs.

18. *Profits from nitrates.*—It is further agreed that when nitrates for fertilizers and fertilizer compounds can be made at a profit, or when the cost of the same has been so reduced that the funds arising from the sources enumerated in paragraph 6 are not needed in whole or in part for financing such productions as herein stated the said funds not needed for operating expenses shall be paid by the lessee into the Treasury of the United States. When said funds paid into the Treasury shall be in excess of the amount received from sale of excess power, as described in paragraph 6, it is understood and agreed that during the period such conditions exist fertilizers are made at a corresponding profit, and the lessee shall be entitled to 25 per cent of such profit.

19. *Consideration.*—In consideration of the performance of the foregoing proposals and conditions, the Government shall agree to pay to the lessee for the completion of Dam No. 2 the initial alterations of nitrate plants No. 1 and No. 2, the completion of the locks at Dam No. 2, the completion of steam plant No. 1 to a capacity of 10,000 kilowatts and steam plant No. 2 to a capacity of 90,000 kilowatts, and, when required by the Government, for the building of Dam No. 3 and nitrate plant No. 3 and the locks at Dam No. 3 and additional dams and nitrate plants and storage reservoirs, the actual cost of the same, respectively, together with a fee of 5 per cent on such cost in each case, in monthly payments, as per estimates of the engineers upon schedules of work performed. The cost in each case is to be determined by the lowest responsible bid resulting from a public offer by lessee and by the contract awarded by lessee to such bidder, subject to approval by the Secretary of War. It is understood and agreed, however, that if the Government shall decide to finish Dam No. 2 that lessee will accept a lease subject to that modification of this proposal.

20. *Payments.*—It is agreed that the engineers representing the Government and lessee shall on the 1st of each month furnish the lessee and the Secretary of War an estimate of the work performed and a statement of the amount earned by lessee during the preceding month.

21. *Stores, stock, and equipment.*—All stores, supplies, equipment, including engineers' supplies, files, and instruments, and other loose personal property now on or about the premises, whether or not required for construction purposes, but not including subsistence stores, shall become the property of the lessee upon the execution of this contract.

22. *Compensation.*—It is further agreed that as compensation for the performance of this contract the lessee shall retain:

(*a*) The proceeds from the sale of 33⅓ per cent of excess power from Dam No. 2 not required to operate the plant or plants, and locks or lifts, the other 66⅔ per cent to be contributed for operating expenses, as provided in paragraph

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6; and when Dam No. 3 is built the proceeds from the sale of 25 per cent of excess power from Dam No. 3 not required to operate nitrate plant No. 3 and locks or lifts at Dam No. 3, the other 75 per cent to be contributed toward the operating expenses as provided in paragraph 6; the same percentage last above named to apply to all other dams and nitrate plants that may be built hereunder: *Provided*, That 20 per cent of such proceeds are to be contributed toward the financing of the manufacturing of nitrates and fertilizers whenever the condition named in paragraph 6, subsection (d), shall occur and while the same shall continue.

(*b*) The proceeds fom the sale of 25 per cent of all by-products for which there shall be a market and not required in the manufacture of fertilizer compounds or mixtures; the other 75 per cent to be contributed toward operating expenses, as provided in paragraph 6.

(c) Twenty-five per cent of the profits on the manufacture of fertilizer compounds, if and when the same shall be made at a profit as provided for in paragraph 18; the other 75 per cent to be contributed toward operating expenses, as provided in paragraph 6.

23. *Power for locks.*—The lessee agrees to furnish to the Government, free of charge, all power required to operate the locks or lifts which are to be operated by the Government.

24. *Emergency provision.*—The lessee agrees to place the property, or any part thereof, at the disposal of the Government in the event of war or any other public emergency, or to operate the same for the Government to manufacture nitrates, explosives, or munitions of war or for other purposes necessary for the safety of the United States, as the Government may require.

25. *Bond.*—The lessee agrees to protect the Government for the full and faithful performances of the contract by giving a good and sufficient surety bond, to be approved by the Government.

26. *Inspection.*—It is agreed that the Government experts, inspectors, and accountants can at all reasonable times examine the books, papers, accounts, meters, and such other accessories of the plant necessary to satisfy them, whether or not the lessee is executing this contract in good faith.

27. *Repairs.*—It is also agreed that should the foundation of Dam No. 2 be found defective or show excessive leakage, the Government will pay to the lessee the expense of the necessary repairs, including a reasonable allowance for overhead.

28. *Proposal divisible.*—The above proposals are submitted for acceptance in whole or in part as provided in section 19 hereof. Upon acceptance it shall be binding upon the Government and the lessee, its successors, and assigns; and all contracts, leases, and other instruments necessary or appropriate to effectuate the purpose of this proposal, as accepted, shall be duly executed and delivered by the respective parties above mentioned.

In witness whereof the United States of America has caused these presents to be executed by the Secretary of War, pursuant to authority conferred upon him by act of Congress, approved the ——— day of ———, 1922, entitled "An act to provide for the lease and completion of Muscle Shoals, and for other purposes"; and the said Frederick E. Engstrum has set his hand on the day and year first herein above set forth.

UNITED STATES OF AMERICA,
By ——— ———, *Secretary of War.*
FREDERICK E. ENGSTRUM.

Mr. BUTLER. Mr. Chairman, before taking up the proposal paragraph by paragraph, I desire to refer briefly to the situation and conditions which have brought forth these hearings.

It is well known that there was an inadequate supply of nitrogen in a form available for explosives and for fertilizers in this country and over the world before the World War; indeed the supply was inadequate for fertilizers alone. The scarcity of nitrogen became acute during the war on account of the sudden need for nitrogen for explosives, while the soil was starved for want of nitrogen in fertilizers. Our supply of nitrogen has practically reached its limit from the old sources; the by-products of coke ovens and other smaller and less important by-products, and from the natural deposit of sodium nitrate in Chile. We are reaching the end of the supply in Chile—the end is in sight.

Hence, we are to-day face to face with a situation where we must get nitrogen from some new source, in order to have an adequate supply for the increasing needs of civilization, to say nothing of the danger of war needs. There is no

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known source of adequate supply, except from the air. Therefore the problem of the fixation of nitrogen from the air is now before us as one of the most important and crucial questions affecting the progress of civilization.

When the World War broke loose we found ourselves—even before we entered that war—where we did not have in sight in this country or where we could get any where in the world sufficient nitrogen for our present and imminent needs. It was a realization of that serious situation which caused Congress to enact what is known as the National Defense Act; that was before we entered the war, June 3, 1916.

Now, Mr. Chairman, while you are all familiar with that act, yet I would like to put section 124 into the record at this point.

The CHAIRMAN. I think it would be a good idea to read that and let it be put in in that way. The committee ought to be reminded of it, perhaps.

Mr. BUTLER. I will read it; it can not be read too often, because to-day we are face to face with the question of whether we are going to go forward with or are going to reverse that declared policy of our Government. That act was passed none too soon. This country would have been more prosperous and in a much better condition industrially to have met that war if we had passed that act sooner, because we needed the nitrogen for fertilizers even before this act was passed, regardless of the threatened additional needs for nitrogen for war purposes.

Section 124 might be called the "nitrogen preparedness" section of that law. It is headed, "Nitrate supply," and reads as follows:

"SEC. 124. *Nitrate supply.*—The President of the United States is hereby authorized and empowered to make or cause to be made such investigation as in his judgment is necessary to determine the best, cheapest, and most available means for the production of nitrates and other products for munitions of war and useful in the manufacture of fertilizers and other useful products, by water power or any other power as in his judgment is the best and cheapest used. He is also hereby authorized and empowered to designate for the successful use of the United States, if in his judgment such means is best and cheapest, such site or sites upon any navigable or nonnavigable river or rivers or upon the public land as in his opinion will be necessary for carrying out the purposes of this act, and is further authorized to construct, maintain, and operate at or on any site or sites so designated dams, locks for improvement of navigation, for power houses and other plants and equipments, or other means than water power as in his judgment is the best and cheapest necessary and convenient for the generation of electricity or any other power and for the production of nitrates or other products needed for munitions of war and useful in the manufacture of fertilizers and other useful products."

That legislation shows that in 1916, while only in the shadow of war, Congress, when preparing for possible war, had in mind the need and provided for more nitrogen for fertilizers, even if war should not come. The great water power on the Tennessee was selected to be developeed and devoted to "nitrogen preparedness" for both peace and war. We at once made plans to build two dams at Muscle Shoals. Dam No. 1 was to be a small dam for the purposes of navigation; Dam No. 2 was to be a great hydroelectric dam to furnish power to operate nitrate plants. We started the construction of Dam No. 2, and also built two nitrate plants, one by what is known as the Haber process and the other by what is known as the cyanamid process for the fixation of atmospheric nitrogen. We also built two steam plants by these two nitrate plants, to be used to supplement the water power during the low-water stages of that river.

When this country entered the war none of this work was completed, so we rushed the completion of the nitrate plants and equipped them to make only the kind of nitrates needed for explosives, and we rushed the completion of the steam plants to run these nitrate plants until the hydroelectric dam (Dam No. 2) could be completed, but the war stopped before Dam No. 2 was half finished, though we did succeed in producing nitrogen for explosives (known as ammonium nitrate) at one of these nitrate plants by the use of the steam power. One of the nitrate plants was not a success, and the war closed before we could redesign it so as to make it fix nitrogen from the air.

After the close of the war, Congress failed to make the necessary appropriation to proceed with the work on Dam No. 2, and to make the changes and additions to these nitrate plants to equip them to make the kind of nitrates needed for fertilizers as well as the kind needed for explosives. The situation to-day is that we have spent $106,000,000 on that great project at Muscle Shoals, but since the war we have allowed that great investment to stand idle, the valuable

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property deteriorating and the greatest water power east of the Mississippi running to waste, while our starved soils are crying for more nitrogen.

Now, Senators, what are we going to do about it? Our duty seems to be too plain for argument. We should not have halted this work at the end of the war. We should have gone forward with the declared purposes of the national defense act. The needs for nitrogen for agriculture are now greater than before the war. We should finish Dam No. 2 at once, and at the same time we should equip both nitrate plants to make nitrogen for fertilizers and put them running day and night as soon as possible.

This investment at Muscle Shoals is not a war-time expenditure on temporary work for a temporary purpose, to be scrapped after the war. It is a permanent investment for a permanent and continuous purpose. The construction is of a solid and substantial nature and designed for permanent use—nothing that should be scrapped—but it should be used for the purposes for which the money was appropriated. The money already spent on the dam is a good investment, but the work already done will soon begin to deteriorate if we do not go ahead and finish it.

We have wasted some money on the nitrate plants, but we knew very little about the fixation of atmospheric nitrogen. We had let everybody else learn more about it than we had, though we were in greater need of nitrogen than any other country in the world claiming to be civilized. So in the emergency of war we were caught without enough nitrogen for explosives alone, and there was no source for a sufficient supply of nitrogen except from the air, and we found that we did not know anything about it. So we went blunderingly ahead to do the best we could with such very limited knowledge as we could gather from others and at a time most unfavorable for getting information from other countries. It is wonderful that we made as much progress as we did.

Senator KENDRICK. Mr. Chairman, I just want to say in confirmation of the witnesses's statement that during the critical period of the war one of the members of the Senate Committee on Military Affairs told me, with a very great apparent spirit of depression, that it looked like not only our country but the Allies were to be entirely cut off from any nitrate supply.

Mr. BUTLER. And because we had allowed our enemies in that war to learn how to secure nitrogen from the air, where there is an unlimited supply, while we knew nothing and had tried to do nothing until the passage of the national defense act in 1916. During the war Germany produced from the air all the nitrogen she needed for explosives; when the war was over she did not stop; she proceeded to produce nitrogen for fertilizers. Last year Germany produced from the air over 400,000 tons of nitrogen for fertilizer, while we did not produce a pound from the air.

The CHAIRMAN. What process did Germany use?

Mr. BUTLER. She used both processes. There are two well-known and successful process; the cyanamid process is the older one; the Haber process is the newest, and the improved method. Germany produced 300,000 tons by that process and 100,000 by the old cyanamid process. The Haber process is the cheapest and most efficient, and all of her new plants are of that kind. They are quite different in their operations in the methods of getting the nitrogen from the air and the hydrogen from the water, and then combining the two to make ammonia; for that is the way we make ammonia, by combining those two elements from air and water and getting rid of the oxygen out of each.

Germany, years ago, as soon as the cyanamid process was a success, put up a number of plants, because she was determined not to be dependent on other countries for her nitrates for munitions or nitrates for fertilizer.

Senator CAPPER. Did the Government put up those plants?

Mr. BUTLER. The Germans?

Senator CAPPER. The German Government.

Mr. BUTLER. They were put up either by the Government or under Government subsidies. The development was all done under Government initiative, either done by the private individuals under Government instruction and with Government aid, or directed by the Government. Is that your understanding, Major Burns?

Major BURNS. My understanding is that they are built with Government aid by private capital.

Senator CAPPER. That was my understanding; Government aid with subsidy, but by a contract.

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The CHAIRMAN. It would be interesting right at this point to know, and can you tell us, Major, with reference to the present condition in Germany, what proportion of the nitrogen is obtained by the cyanamid process and what proportion by the Haber process?

Major BURNS. They are making, all told, in Germany to-day, as I know it, 500,000 tons of nitrogen and 300,000 tons are manufactured by the Haber process, 100,000 from the cyanamid process, and 100,000 tons from by-product coke-oven ammonia.

The CHAIRMAN. What power do they use for the cyanamid process?

Major BURNS. They have used steam power, I think.

Mr. BUTLER. They have no water power, practically, in Germany?

The CHAIRMAN. That is my understanding. The point I want to reach is: Their production by the cyanamid process, therefore, must be very expensive.

Major BURNS. Yes, sir; it is; and it is unquestionably going out of existance in Germany.

Senator HEFLIN. That was the question I was going to ask, Mr. Chairman, as to how Germany derives her power, whether from water or steam.

Major BURNS. I think she derives it from steam.

Mr. BUTLER. That is practically all she has.

The CHAIRMAN. I think it is conceded, Senator Butler, by the experts, that we could not get nitrogen from the air by the cyanamid process without a cheaper power than we could get from steam and produce it at a price that would even compete with the present market.

Mr. BUTLER. That is true. Germany finding the cyanamid process very expensive by steam power, and determined not to be dependent upon a supply as far off as Chile, in a foreign country, put her scientists to work to find a cheaper process. They reasoned that since nature has so built a plant that it breathes air into its lungs and takes out the nitrogen for its growth, and that humans are so built that we breath the air into our lungs and take out the oxygen for our growth, that man should be able to study out a method to do the same thing artificially.

They worked out first the cyanamid process, but were never able to improve it to where they could make nitrogen economically with steam power. Since they have no water power and never can have, they began to look for a cheaper process. The result is the Haber process, which is much cheaper and much more efficient, in every way. And this process is thought to be capable of much more improvement. That process is just in its infancy, and either the Germans or we or somebody will greatly improve that process soon. Everybody agrees that the Haber process is susceptible of development and improvement to a greater extent than is possible under the old cyanamid process.

The CHAIRMAN. One of the great distinguishing features between the two processes is that in the cyanamid process power is the principal expense, because it requires so much power, and under the Haber process the power is a very inferior consideration.

Mr. BUTLER. That is true; the Haber process requires much less power; that is one of its economies, but it otherwise is a cheaper and more efficient process. The cyanamid process is a proven success; the only trouble with it is that it is expensive, and its use is practically prohibited except where there is an abundance of cheap water power. It was the want of water power primarily that drove Germany to search for a cheaper process. All that time, however, we have had an abundance of water power which we have allowed to run to waste like a drunken sailor spends his money; we have been talking conservation, yet we have never applied conservation to water power. You can not conserve water power by leaving it for the use of future generations like you can coal and timber. The only way to conserve water power is to use it every minute. When it has gone over the dam it has gone forever—it is wasted. With our great abundance of water power going to waste, we could have outstripped Germany every day under the cyanamid process, making nitrates cheaper than she made them—cheap enough to sell to her and the rest of the world—but we didn't do it. Next, Germany is forced by necessity to work out the Haber process, yet we permit ourselves to be caught in the late war without having ever produced a single pound of nitrogen from the air by either process. We have been so busy making money by using up the great store of natural resources which Providence has put here since creation that we have not used our creative capacity and our inventive genius as we should. We have done but little thinking; we have not encouraged anyone to think.

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And so, in a way, we have been a very unprogressive and an improvident Nation. We have never properly encouraged initiative so to develop scientists and inventors. We have actually driven some of our greatest inventors abroad for encouragement and help. In the beginning we drove Fulton to Europe with his steamboat. We drove Maxim to Europe with his inventions. We drove the inventor of the airplane abroad to finance his invention.

Senator KENDRICK. We did the same with the submarine, did we not?

Mr. BUTLER. Yes; we also drove the inventor of the submarine abroad. I was a member of the Senate Committee on Naval Affairs at the time. The original submarine was brought here in the Potomac River for inspection and demonstration. I could not induce many to go and look at it, much less to go down in it. We refused to help the inventor and drove him abroad with that great invention.

The CHAIRMAN. Maybe that failure came from the fact that you tried to make people go down into it.

Mr. BUTLER. I was willing for them to look at it and then come back and vote enough money to buy that one boat, but we failed.

The CHAIRMAN. I went down in one, and while I would not miss the experience, I would not give a nickel to go down in another.

Senator HEFLIN. I went down in one also.

Mr. BUTLER. But it should be said to the credit of our graduates from Annapolis that, as dangerous and as uncomfortable as the submarines were at first, yet there never was an hour that we did not have some of our boys ready to volunteer their lives to work out the art; they appeared before the committees of Congress and offered their services, if the Government would buy that boat. That was a typical exhibition of what real American spirit is when it is put to the test. All I have been saying to our discredit does not discredit the raw material that is in us, but we have not used it. We have not, as a people, and as a Government, utilized the resources and opportunities before us.

Senator HEFLIN. You spoke a little while ago about the nitrate supply of Chile nearing exhaustion. Is that the situation?

Mr. BUTLER. I think that there is no controversy on that point. The Chilean deposit can not last longer than 25 years, at the present rate of use. But our demand for nitrogen is increasing at the rate of 7½ per cent a year; so if we are to depend uopn Chile for our supply, we will be calling on her in 10 years for twice what we are getting now. But no matter how long that deposit may last, it is certain to give out some time, and each year the supply will get scarcer and the price will go higher. Do we want to force our agriculturists to depend on such a supply and to be at the mercy of an unregulated price. The price of Chilean nitrates is now too high compared with the selling price of farm products.

To-day our farmers would use twice as much nitrogen if they could get it cheaper. It is the high price, and not the indisposition of our farmers to use the nitrogen that caused us to use only 175,000 tons last year, while our soil needs several times that amount. Besides we must remember that we could not get from Chile during the war a sufficient supply for explosives alone.

Senator KENDRICK. I wanted to ask a question, if I may, Mr. Chairman.

The CHAIRMAN. All right.

Senator KENDRICK. On about what date was the first real production made of fixed nitrogen from the air?

Mr. BUTLER. I am not sure of the date. Major Burns, are you?

Major BURNS. I think the cyanamid process came into being about 1908 or 1909.

Senator KENDRICK. That would be about twelve years?

Major BURNS. Fourteen years ago. And I believe the Haber process came into being about 1913 or 1914; just prior to the beginning of the World War.

Senator KENDRICK. Has there been great improvement made in the process since that time, or has it stood rather stationary?

Major BURNS. The cyanamid process is practically a perfected process at the present time. There are very few additional possibilities. That however, is not true of the Haber process. There are many possibilities in it. For instance, in the welding together of the gases, nitrogen and hydrogen, you only weld to the extent of about 6 or 7 per cent. The other 93 or 94 per cent is not joined at all. If you could get a better catalist, a little better process, you can unquestionably, in the future, weld these gases to a much greater percentage, and it will have a very marked effect upon the efficiency of the process.

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Senator KENDRICK. The object of my question is to indicate the possibilities of cheapening this process so that in the near future we may have an output, or production, as the witness has testified, at a cost that will enable farmers of our country to use just as much of it as they think is required for the soil.

Mr. BUTLER. I am coming to that under the re-designing of these plants, because they are now equipped to make only nitrates fit for explosives.

During the war we did the best we could in building those two plants. The cyanamid process, as Major Burns says, was a completed process and we knew all about it, though we had not used it. But we knew practically nothing about the Haber process, because Germany had recently worked it out and besides she kept the process a secret as far as she could. Therefore, when we built those two palnts down at Muscle Shoals, plant No. 2, the cyanamid process, was a success, because we knew all about that, and we had cheap water power there, so if we had gotten Dam No. 4 finished, we could have made nitrates there cheaper than Germany could by that process.

The great point with the process is to find the cheapest water power possible. With the finishing of Dam No. 2, we can probably produce nitrates by the cyanamid process at Muscle Shoals cheaper than they can be produced anywhere else in the world by that process. We hope soon to produce nitrates by even that old and expensive process cheaper than the present selling price of Chilean nitrates.

Now, we hope to do it, but it has not been done yet. We will probably start at a loss with the cyanamid plant; the experts of the Agricultural Depjartment and the experts of the Ordnance Department say we will start at a loss. But we are very hopeful that that condition will not last very long and certainly it will not if we can figure it on the basis I have just stated. We do feel, however, that from the start we can, by the Haber process, make nitrates that will compete with the present selling price of Chilean nitrates.

Nitrate plant No. 1 will have to be changed very much. When we built that plant we did not know anything about the Haber process. We just experimented, we did the best we could. But our failure turned to be a blessing to us in a way, because it put our experts in the Agricultural Department and in the Ordnance Bureau of the War Department to studying on their own initiative how to make that plant a success; and if the war had gone on much longer we would have made nitrate plant No. 1 a complete success. We know now how to make it the best Haber-process plant in the world.

We did not know during the war what catalist the Germans used. That was one of their secrets. Each country to-day that is making nitrogen from the air by the Haber process has its own catalist, which is a secret. It is a metal or a composition that will perform a certain function. A catalist is different in different combing processes. Platinum will act as an effective catalist to form some combinations. It won't do it in this process. Everything that was known to be an effective catalist in any combination of elements would not serve to tie nitrogen and hydrogen together to make ammonia. It seems to require a certain combination of metals. While Germany has her combination, we had no effective combination, and we could not get hers, and, as Major Burns has just told you, that was our chief trouble at that plant. Our experts went to work during the war to produce an effective catalist, and they did not stop, fortunately, when the war stopped. Congress stopped thinking when the war stopped and would not vote any money to finish this project, but, fortunately, our experts did not. Having gotten their minds started, they continued to study how to make an effective catalist, and we have, since the war, produced the most effective catalist in the world. Our catalist is a secret. It should be kept a secret. But we have tested it, and while the German catallst is only 6 per cent efficient—those are the figures, are they not, Major Burns?

Major BURNS. Those are approxiately the figures.

Mr. BUTLER. Yes, and our catalysis is 16 per cent efficient, according to tests made here in Washington. So we have perfected a catalysis that ties together 16 per cent of the nitrogen and the hydrogen, which is the best catalysis in the world. This is one of the good results that has come from the war. We think when a war is on we make progress, but we ought not to stop when the war is over. That invention is lying right here in the possession of the Government and is not being used. We can put that catalysis down there in nitrate plant No. 1 and surpass Germany almost three times in efficiency, and any other country, so far as we know.

The CHAIRMAN. Now, Senator, is it not proper to say that this 16 per cent is really a laboratory test, and has not been tested out in real manufacture?

Mr. BUTLER. Yes; that was a laboratory test, and while we do not usually get as good results in practical operations as we get in such tests, yet I think it safe to say that we feel sure that we now have a catalysis which is about twice as efficient as the German catalysis. I was going to make that explanation in a moment; but one thing is certain, and that is that we have to-day the most efficient catalysis in the world, and one which we expect to be at least twice as efficient as the German catalysis. Is that in harmony with your judgment, Major Burns?

Major BURNS. I think that is essentially correct; yes, sir.

Mr. BUTLER. Then, Mr. Chairman, we have a catalysis which in practical operation will be twice as efficient as the German catalysis. Shall we keep it idle any longer?

Now, that is not all we have learned about the fixation of atmospheric nitrogen. We have learned how, when redesigning that nitrate plant No. 1, to change it in other important respects so as to make it the best Haber process plant in the world. Since the war there has been built a small Haber process plant at Syracuse, N. Y., a private enterprise, by the company that tried to help us build this plant. They learned enough about the German method since the war that they have built a successful Haber process plant, about a 10-ton capacity plant at Syracuse, and it is now operating, and operating successfully.

Senator KENDRICK. With steam power?

Mr. BUTLER. Yes; but that plant is not as efficient as this plant No. 1 will be when we have put these improvements in it, because we have learned how to get rid of the coke and water method of getting the hydrogen out of the water by passing water air over heated coke. That is the method Germany uses; but it is not as good as the electrolytic method. She has coal, but she has no electricity.

When we redesign plant No. 1 we will take out the cock and water process and put in an electrolytic cell that has been developed by the Bureau of Ordnance, War Department, since the war; it is to-day the largest and the most efficient electrolytic cell in the world. Up to the time—what was the largest cell, Major Burns, in existence when you built that 10,000-ampere cell?

Major BURNS. I think it was a 250-anpere cell.

Mr. BUTLER. A 250-ampere cell was the largest successful one that had ever been built for using electricity for this purpose. The Ordnance Bureau has built one 10,000-ampere cell that is a decided success. The efficiency in a great project like this of a 10,000-ampere electrolytic cell for getting the hydrogen from the water is a wonderful step forward. Now, when we put in that electrolytic cell we will also make another important change in the Haber process as used by Germany and as now used in the Syracuse plant; we will put in the liquid-air method, which you can use when you put in the electrolytic cell, for taking the nitrogen from the air.

Then we will have three important improvements on the present German Haber process when we redesign nitrate plant No. 1. We will have the most efficient catalyst in the world, made by our Agricultural Department, considered by everyone to be, conservatively, twice as efficient as the German catalyst; we will have an electrolytic cell, developed by our Ordnance Bureau, that is the most efficient one in the world, using electricity to take hydrogen from the water; we will use the liquid-air process, which you can use when you use the electrolytic cell, for taking the nitrogen from the air. We will tie the nitrogen and the hydrogen together with that catalyst, and we will have the most efficient Haber-process plant in the world. When that plant is redesigned with these improvements we will expect to be able to make nitrates in competition with the Chilean nitrates and soon to reduce and stabilize the price.

But this wonderful art is in its infancy. We would not be discouraged if we failed to make nitrates cheaper than Chilean nitrates the first day. The way to learn to walk is to walk. The way to learn to make these nitrates cheap is by doing it, not by sitting down and waiting for somebody else to do it, for then they will keep the secret from us, both in peace and in war. No people in the world have greater capacity for inventive genius and for improvement than we have; if we direct our attention to the development of this art, we will accomplish the result desired.

Now, under this proposal we will redesign those plants with these three important improvements to begin with. We will employ the best experts in the world to do this work and then to run these plants. We will also have a research plant there, where our own experts and the experts of the War

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Department and of the Agricultural Department will be cooperating with us in developing this great art. We will be giving our whole time to this thing, so nobody in the world should be able to outstrip us in the improvements for making cheaper nitrogen. It is certainly within the realm of possibilities to make nitrates cheaper than Chilean nitrates at an early date. It is within the realm of probabilities that it will be done within the next few years. Under these conditions improvements move fast. The incentive for getting nitrogen from the air is so great that we will wake up some morning and find that further improvements have been made in the Haber process which will decrease the cost 25 per cent or 33⅓ per cent or 50 per cent, and if we don't do it somebody else will. Indeed, we are on the edge of this most wonderful development, which means so much to civilization.

Senator KENDRICK. Is it not your opinion that in all probability within a period of 5 to 10 years, with the Government operating this plant economically, we will say, with the secondary power of that dam, they will save in one year in cost of fertilizer to the farmers of this country the entire investment in the dam at Muscle Shoals?

Mr. BUTLER. Senator, that is a very conservative statement. It is possible and even probable that we can do better than that if we devote this whole project to this one great purpose.

Senator KENDRICK. I will say this right here: That after looking at the perfectly wonderful character of the initial improvements made at Muscle Shoals, I have been unable to see how any good business man could even for a moment consider a plan of junking that property.

Mr. BUTLER. To my mind it is a shocking suggestion. Every consideration for "nitrogen preparedness" for both peace and war condemns such a proposition as most unwise.

Senator KENDRICK. Well, in the interest of preparation for war—of course, war seems remote now, but it seemed remote when the war opened.

Mr. BUTLER. It seemed as remote a year before it came as it does now.

Senator KENDRICK. I for one did not believe they were going to fight after they commenced to kill each other over there.

In the interest of preparation for war and in the interest of the increasing need—not demand necessarily, but the need—for this fertilizer, the Government ought, with the impetus it now has, to proceed to develop that plant and show what can be done.

Mr. BUTLER. It should be done, even if we did not need the nitrogen for fertilizer, as a matter of preparedness for national defense. We were forced to rush up these plants during the war to get enough nitrogen for explosives alone. During the war our Government preached to our people that the making of biscuits was just as important to win the war as the making of bullets, but we were forced to "make bricks without straws," because we had no nitrogen left for agriculture. In modern warfare the country that will finally win, other things being equal, is the country with the greatest resources and the greatest wealth; it is the country which has the last pound of beef and the last pound of flour that will win the war.

We are not now producing what we should produce in this country. We are letting our wealth producers waste their time, energies, and money on a starved soil, producing half what they should produce, for the want of enough nitrogen. We are using to-day only one-quarter of the nitrogen on our soil that Germany is using. We are using only one-quarter of what England is using. We are using not even half as much as Italy and France are using. We are starving our soil and paralyzing the energies of our people. We can't make two blades of grass grow where one is growing now unless we put more plant food into the soil. The most important and the most expensive element of plant food is nitrogen. We must have more of it, and we must be able to get it cheaper. Even the richest parts of our country are now waking up to this need.

Take Senator Ladd's rich country. Twenty-five years ago I looked down Red River Valley in that wonderful wheat country, the wheat just ripening; it was the most beautiful sight I ever saw; it was made without fertilizer then. Nature has stored up there from the beginning of creation a great supply of plant food so that they could produce those wonderful crops of wheat without using any fertilizer. I might put a thousand pounds of fertilizer on the best soil I have down in North Carolina and I could not even then produce such wheat. But to-day that rich valley can produce only about half as much wheat per acre. Is not that about true, Senator Ladd?

Senator LADD. That is true.

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Mr. BUTLER. And now, Senator, you were down the other day in my State, the eastern part of the State, and saw our soil, in which nature has put practically no nitrogen.

Senator LADD. Yes.

Mr. BUTLER. You saw how white it looked. It looks even whiter now than it did before the war. We were struggling before the war to nourish the soil, buying what fertilizer we could and turning under green crops so as to make humus. We were changing our white sandy soils to a dark and loamy soil by adding nitrogen each year. But it looks whiter now than it did before the war. Why? Because we could not get enough nitrogen. So to-day we need nitrogen more than before the war, but we are not putting it into the soil, because it is too scarce and the price is too high. We used last year in the whole country only 175,000 tons of nitrogen for fertilizers, while we should have used at least four times that amount. Even the small country of Germany used last year 500,000 tons for fertilizers. The needs for nitrogen, even in the rich Northwest, will grow greater each year. With the whole Muscle Shoals project devoted to the production of nitrogen we will not produce as much as this country needs for fertilizer alone.

In the face of these conditions I can not believe that Congress will scrap Muscle Shoals or sell it at scrap prices to parties who will take this great property and use it all or nine-tenths of it for private manufacturing for private profits. That would be slapping agriculture in the face while it is crying for nitrogen, and it would be giving a subsidy to private parties to compete with other manufacturing concerns. Now, to do nothing would be almost as bad. I have heard it suggested that we had better let it go over a year, because it is too big to act on in a hurry. It is too big to let it go over; the need for action is too pressing.

I want right here, as a citizen, to urge with all possible earnestness that you do not allow this session of Congress to pass without putting that great water power and that large investment to work to carry out the purposes declared in the national defense act. If you do not think that the Engstrum proposal is the most efficient way to accomplish that purpose, then, in heaven's name, pass Senator Norris's bill and have the Government do it. Somebody should do it. This thing needs greatly to be done. It affects not only the farmers but it affects every consumer in America as well. And, besides, it will affect our national safety in the next war, as it did in the last. It is inconceivable that our Government will scrap this great property and refuse to go forward with the work of "nitrogen preparedness." It is equally inconceivable that you will sell this valuable properwty at scrap prices and turn over this great water power to a private monopoly for private gain, with only one-tenth of this power at best used in making nitrates and fertilizers. Such action would mean the robbing of agriculture of all chance to get an adequate supply of cheap nitrogen, the robbing of the people and the industries around Muscle Shoals of a chance to buy light and power at a reasonable price or at any price, and also it would mean the granting of a Government subsidy to a private monopoly in competition to all other American citizens. Such a use of public money is indefensible from every standpoint.

With that preliminary statement, Mr. Chairman, I will now take up the proposal: The first paragraph of the proposal provides for the formation of a corporation to operate this property under the lease. There are to be seven directors, two of them are to be appointed by the Government, one by the Secretary of Agriculture, and one by the Secretary of War. It seemed to us eminently proper, from our standpoint and from the Government's standpoint, that there should be some one representing the Government sitting on the board of directors, not only to have the right to see and know what we were doing, but also to advise with us as to what to do. The Government has experts, who should sit on the board of directors of any company that handles this great project, and we have invited the Government to furnish them.

Paragraph 2 simply covers the designation of the property that is to be leased for 50 years. As this proposition was first written and submitted to the Secretary of War and transmitted by him to the Congress, we included the Warrior steam plant in the lease. That is a very desirable property to have in connection with this lease; being at the coal mines it is the cheapest power we could get to operate these nitrate plants and do construction work until we finish Dam No. 2. It would be most desirable for that reason.

Senator KENDRICK. Right in that connection there, you have excluded it by your amendment?

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Mr. BUTLER. We have excluded it.

Senator KENDRICK. I wanted to ask why you have included the transmission line if you do not have the plant?

Mr. BUTLER. The transmission line will be very useful under this lease, because we will want to tie up this property to the best customer for the excess power which we will have to sell. It is now tied up with the Alabama Power Co., but we want the right to remove it or to keep it where it is. The transmission line belongs to the Government absolutely. There is no mixed title there. We want the right to either keep it there or remove it where it could be used to the best advantage of our company for this lease. We have excluded the Warrior plant because of the difficulties and the delay that the Government might have in securing a title—if there was litigation about this matter. We have amended the proposal so there would be no entanglements and no delay in proceeding with the development and operation of this project. But if it is possible to put it in this lease, without delay and litigation, we still want it.

The CHAIRMAN. Well, Senator Butler, do you think it is possible to put it in without delay and litigation?

Mr. BUTLER. I am afraid not.

The CHAIRMAN. I think we ought to face these things as they are and not as we would have them. I can see the importance of having it in and including it, but after looking it over and examining the intermixture of the property down there, it seems to me an impossibility to divide it. If there is a way to divide it I would like to have somebody explain it.

Mr. BUTLER. We have eliminated it from the lease for that very reason, though it would be most desirable to have it in the lease.

The CHAIRMAN. If we were able to take it over it would have to include the coal mines there, would it not?

Mr. BUTLER. Yes.

The CHAIRMAN. In other words, you would not want the plant without the coal?

Mr. BUTLER. Certainly not.

The CHAIRMAN. It would be a physical impossibility, really, to divide the property, or the title to it.

Mr. BUTLER. It would be a matter of the Government buying the Alabama Power Co.'s interest.

The CHAIRMAN. Either the Government must buy it or they must buy it.

Mr. BUTLER. That is all there is to it. Either the Government must buy it or they must buy it.

The CHAIRMAN. It takes two to make that bargain?

Mr. BUTLER. We have given up that most desirable plant in this lease, because of the danger of delay by disagreements or by litigation. Therefore, it was necessary for us to amend paragraph 4 to include an increase of capacity in steam plant No. 1 and steam plant No. 2 at Muscle Shoals. If we are not to have the Warrior plant, we certainly will need some more power, and it can easily be furnished, because steam plant No. 2 at Muscle Shoals is designed for 90,000 horsepower; no; I think it was 90,000 kilowatts, was it not, Major Burns?

Major BURNS. It was designed for 90,000 kilowatts, with boiler installation for 90,000 kilowatts.

Mr. BUTLER. Boiler installation for 90,000. We have now installed the electrical machinery for only 60,000 kilowatts. It that correct?

Major BURNS. That is correct.

Mr. BUTLER. So we have a plant designed for 90,000 kilowatts of power, with the foundation, buildings, and boilers already there for that capacity; it just needs the 30,000 kilowatts electrical machinery added to double the capacity of that steam plant.

Senator HEFLIN. You do not mean that if the Government should accept Mr. Ford's offer or the Alabama Power Co.'s offer for Gorgas plant we would have any right to take those private coal mines away from people around there and turn them over with it, do you?

Mr. BUTLER. The Government or the lessee of Muscle Shoals would have to get the coal from the owners on the best terms they could.

Senator HEFLIN. Certainly. Would not Mr. Ford have to buy his coal from these coal miners there, and would not the Government have to buy it? I understood you, in response to a question by the chairman, to say that if we took the Gorgas plant we would have to take the mines also. What right would we

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have to take private coal mines or private individuals unless it was done for an emergency purpose?

The CHAIRMAN. Senator, the Gorgas plant would be no good to anybody unless it had the coal mine there with it. That is the reason it is an advantageous proposition, because it is right at the mouth of the mine.

Senator HEFLIN. That is what I am saying; but what right have we got to take those mines? Would not anybody who got that plant have to buy the coal from those people who own the mines? What right have we, under the law, to take those mines?

The CHAIRMAN. I see the point you make. You would buy the coal instead of buying the mine. Suppose the owner of the mine would not sell us the coal. Then, what good would our plant be? Would we not be at his mercy? If we did not own the coal mine itself, they could hold us up, because we could not get coal anywhere else very well.

Senator HEFLIN. It is true; but they make money from their operation of the coal mines.

The CHAIRMAN. I should think so; but it is rather human nature for some people when they get a chance to hold up an individual, even the Government. They do not hesitate when they have the opportunity.

Senator HEFLIN. Suppose you and I own the coal mine, and we sell coal to various people of the State. What right would the Government have, if it sold that steam plant to a private individual, to sell my mine and yours to a private individual?

The CHAIRMAN. I think that is one of the legal difficulties involved in this proposition, and a very serious one, to my mind.

Mr. BUTLER. If the Government bought the Alabama Power Co.'s interest and leased it to us, we would have to get the coal just as the Alabama Power Co. gets it, to operate it. Of course, that would be one of the problems we would face.

Senator HEFLIN. I don't know but the Alabama Power Co. owns some mines there itself.

The CHAIRMAN. It owns that mine that supplies the coal to operate the Gorgas plant. They own all that land, as I understand it. Of course, I never looked up the title to it.

Mr. BUTLER. They own some coal, which they are now using to run that plant. I know that.

The CHAIRMAN. The mine is right there. I went into the mine when I was down there, and it is like going into a submarine. I don't care to go into another one.

Mr. BUTLER. Do you understand, Senator, that most of the coal around there, outside of what the Alabama Power Co. owns, is scattered, with ownership in a number of different individuals?

Senator HEFLIN. Yes.

Mr. BUTLER. It is just a question of bartering with them and making contracts both to buy their coal and to sell them light and power?

Senator HEFLIN. That is my understanding. I saw some gentlemen that said, "We have got mines here that are served by this Gorgas plant, and if you dispose of this plant how are we going to get service?"

The CHAIRMAN. That is, their power?

Senator HEFLIN. Light and power.

The CHAIRMAN. To work the mines. There is no doubt about that. There are other owners there of other mines in that vicinity, that get their power from the Alabama Power Co. to operate their mines.

Senator HEFLIN. I said to him, "I suppose whatever disposition is made of the Gorgas plant you will continue to get your light and power from it."

The CHAIRMAN. If we got the thing, and the lessee got from us the Gorgas plant, which included the mine that supplies it, there would be one of the legal difficulties that would arise, because I presume they have made contracts to supply other parties with power there to operate their mines, and they themselves would be liable to damages. Somebody would have to pay those people their damages.

Senator HEFLIN. Whoever gets that plant, these people ought not to be deprived of the light and power that they are now getting out of the plant.

Mr. BUTLER. The transfer of the plant would carry those contracts, unquestionably; the lessee or the Government would take it subject to those contracts.

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I understand there is an abundance of coal around and above Muscle Shoals on the river. With the opening of this river for navigation the coal question will solve itself.

The CHAIRMAN. Senator Butler, for the benefit of members of the committee who were not down there, let me say that this coal supply over at Gorgas on the Warrior River can not be utilized. The coal over there can not be utilized at Muscle Shoals unless you ship it by rail. It is on a different watershed. There is no water transportation, no matter how much we improve the Tennessee River.

Mr. BUTLER. Elsewhere, up the river, I mean.

The CHAIRMAN. Elsewhere you could, but you can not get it from those coal fields around Gorgas.

Mr. BUTLER. There are other coal supplies much nearer Muscle Shoals than that coal supply at Gorgas. If we cut out the Gorgas plant that coal cuts no figure in this proposition. We could buy coal up and down the river.

The CHAIRMAN. That is a question we have been inquiring of the witnesses, and nobody has given us any definite information on it. It is quite important if we do not get the Gorgas plant to have some coal on the Tennessee River where we can utilize the transportation facilities of that stream to get the coal up to Muscle Shoals. Now, do you know of any coal along the Tennessee River that can be used?

Mr. BUTLER. I am sure there is plenty of good coal up the river. Major Burns, has not the Ordnance Department gone into that?

Major BURNS. I would like to say, Senator, that Colonel Barden very definitely stated in his testimony that there was coal along the Tennessee River that would be reached by the improved navigation facilities.

The CHAIRMAN. Where?

Major BURNS. He very definitely stated there was a supply of coal in the upper Tennessee that could be used for the steam plant.

The CHAIRMAN. It is a very important point, because the reason everybody wants to maintain the Gorgas plant is because of the cheap power from coal. That country there at Gorgas is all filled with coal everywhere up and down the Warrior River, but there is no way to get it over to Muscle Shoals by water transportation, and that makes it expensive, unless you would ship it down the Warrior, through the Gulf of Mexico, up the Mississippi and Ohio and Tennessee, which would be, of course, too far.

Mr. BUTLER. Of course by water transportation coal can be brought up the river cheaper than it would be to transport it by rail from Gorgas, but when that river is opened to navigation there are many places up the river where we could get good coal. I am sure that the Geological Survey will confirm this statement.

The CHAIRMAN. Of course the desirable thing is to get the coal as close as possible to the Muscle Shoals, even though it is transported by water transportation.

Mr. BUTLER. We satisfied ourselves on this coal question up the river before we decided to eliminate the Warrior steam plant from this lease. Besides, as we develop this Muscle Shoals project the necessity for coal will diminish gradually; the building of storage reservoirs on that river will lessen the need for coal. Storage reservoirs is an engineering and an economic question of no little importance, and this is why we have thought it desirable to secure the greatest engineers that we could find anywhere to solve it. We must get all the water possible to do the work. When we can impound the water up the headwaters of this river and its tributaries so as to get over that low-water period the coal question gradually vanishes. If we make the progress we expect in developing this river, we can build many other nitrate plants and run them by the power from other dams and storage reservoirs. That is the way to make cheap nitrates.

The CHAIRMAN. Of course I think it ought to be said at the present that is rather an unknown proposition. We do not know what the possibilities are, even.

Mr. BUTLER. We know enough about it to know that it can be done. It is a question of economy to be solved by engineers.

The CHAIRMAN. Of course there is no doubt but what it can be done, but even when you come to do it the question arises at once as a financial proposition, Will it pay to store this water?

Mr. BUTLER. It would not pay any private individual, but the Government can afford to do it as a perpetual investment. When you build a storage dam it is built forever—a perpetual investment. Think of the potentiality of this

water stored, to be let out in the dry weather, to make secondary power into primary power, and thus save forever the enormous cost of coal. It is a matter of such enormous importance that the Government can afford to do that to carry out most efficiently the purposes of the national defense act. I say to you frankly that if we have this contract we will soon be camping on Congress with the engineering data that will convince you about the wisdom of building storage dams.

The CHAIRMAN. Senator Butler, I do not think there is any doubt but what when we consider it in its broadest aspect, as the Government ought to consider it, you can not get away from the storage proposition, even though it would be quite expensive, because when you come to amortize a proposition——

Mr. BUTLER. Forever.

The CHAIRMAN. And spread it over 10 years and then amortize it again and spread it over a hundred years you have almost eliminated the cost.

Mr. BUTLER. This will be spread over a thousand years and more.

Senator KENDRICK. Then would it not serve another great beneficial purpose in reducing the danger and loss by floods?

Mr. BUTLER. Certainly. It would largely remove the danger from floods, and it is the only way to remove it. And it will conserve the flood waters and make them do constructive instead of destructive work, and also, of course, make navigation more reliable. To thus harness and utilize this water will justify the expenditure of almost any amount of money.

Senator KENDRICK. It is easily believeable that the saving of damage caused by floods at times would amount to the cost of the dam.

Mr. BUTLER. That is entirely probable, and when we also consider the valuable use this stored water will serve in the increased water power for the dry periods, it becomes of such importance as to justify the cost.

Those are things that we intend to have our engineers to work out and place before you if we are given this lease. It is a part of the program of development which we have in mind, as you will see from the wording of our offer.

It will also be noticed at the end of paragraph 4 that we do not require the immediate building of Dam No. 3. We do that because it will make the cost very materially less to start with, and besides, we want to get that Haber process plant (No. 1) redesigned with the three improvements which I have mentioned and try it out before building the nitrate plant at Dam No. 3. It would not be justified at this time for navigation alone. In the next place, having those two nitrate plants there and Dam No. 2 one-third finished, the commonsense business thing for the Government to do is what you and I would do as private individuals if it were our own property. We would finish that dam, and we would redesign both those nitrate plants and put them to work as soon as possible. We would also work out other improvements in the process through our research plant, and then, just as quick as we were sure of success in the making of cheap nitrates, we would build Dam No. 3 and put up a new nitrate plant by the most improved methods that we had found. In truth, Mr. Chairman, by the time we can finish Dam No. 2 and by the time we can get these nitrate plants equipped and in operation, we expect to have made such developments as will justify the building of Dam No. 3 and nitrate plant No. 3 at once, because if we can show you that we are making nitrates cheaper than Chilean nitrates you are going to authorize us to make more of it. Indeed, we can not make at those two plants one-half of the nitrogen that this country needs for fertilizer alone. Instead of scrapping one of them, we should run both.

We used last year about 175,000 tons of nitrogen in this country. We ought to have used more than twice that much. Not one pound of that came from the air. About half of it came from coke ovens, and the rest of it from Chile. We used all we could get from the coke ovens, and we used all we could afford to buy from Chile. We used last year only 5,000,000 tons of fertilizer. The Agricultural Department says we should have used 10,000,000 tons. In another 10 years we will want 20,000,000 tons.

Senator HEFLIN. How many tons do you figure we would be able to produce at Muscle Shoals?

Mr. BUTLER. By running both plants at their full capacity we would produce about 230,000 tons of nitrogen in the form of ammonium sulphate, and that will make something over 2,500,000 tons of fertilizer, with the average amount of nitrogen now being put into fertilizers.

Senator HEFLIN. I notice you say in your offer, "It is further agreed that the lessee shall sell all nitrates and fertilizer compounds produced by the plant

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at prices and on conditions and terms approved by the Secretary of Agriculture."

Mr. BUTLER. Yes. We propose to submit a schedule of price and method of distribution for approval.

Senator HEFLIN. That would give the farmers of the country an opportunity of knowing about what it would cost to produce fertilizer?

Mr. BUTLER. Yes.

Senator HEFLIN. And it would have a stabilizing effect on the price, and don't you believe that would mean a saving of $100,000,000 to the farmers of the United States of America?

Mr. BUTLER. Of course it is bound to stabilize the price, and it will save every dollar of that amount.

Senator HEFLIN. That is what I say.

Mr. BUTLER. Chilean nitrates would be sold at the price we sold our nitrates, or they would not sell at all. The same as to complete fertilizers.

Senator HEFLIN. Would not that, in your judgment, then, be a saving of $100,000,000 to the farmers of the United Sttaes?

Mr. BUTLER. In my opinion it will save more than $100,000,000.

Senator HEFLIN. You think a hundred million is a very conservative estimate?

Mr. BUTLER. Yes; and the amount saved will be greater each year.

You will notice that we put into that paragraph also the words, "Under rules and regulations of the Secretary of Agriculture." I tell you frankly we are going to submit to the Secretary of Agriculture a schedule of sale under which we are going to sell these nitrates without mixing them into a complete fertilizer, as far as he will let us. The Department of Agriculture has been trying to teach our farmers not to buy mixed fertilizer, but to buy the ingredients and mix the fertilizer themselves. There is an enormous saving in buying the ingredients and mixing your own fertilizer. You get rid of the cost of mixing, and you save the freight on the filler, which contains no plant food. There is no sense in our company wasting our energy and taking our time in mixing fertilizer, when we ought to be devoting all our time to making cheap nitrates, which is the important thing. So we will ask the Secretary of Agriculture to let us offer these nitrates, ask the farmers to buy the other ingredients, and mix them themselves. Further than that, we will ask him to let us offer the nitrates to anybody—to the fertilizer companies as well as the farmers, and at the same price—because if there are farmers who will not mix their own fertilizers, but want to pay somebody else to do it, then let them pay the fertilizer companies. If the fertilizer companies will do it at a reasonable price, then let them do it, and let them go on and run their business at a reasonable profit. The Agricultural Department wants to teach our farmers to mix their own fertilizers, and the most progressive ones are now doing it. We shall offer to sell the nitrates without mixing them. But we will mix some, if required by the Secretary of Agriculture to do it.

Senator HEFLIN. In other words, the farmer could then pay the freight upon the ingredients, whereas if you would mix it he would have to pay the freight on 4 or 5 tons, as against 1?

Mr. BUTLER. Certainly. Then, too, he has got to pay some one a good profit to mix it. The farmer who mixes his own fertilizer saves one-fifth to-day of his fertilizer bill. The wise farmer buys these ingredients and then makes a mixture to suit each crop and each kind of soil.

It is like a prescription for each disease, not the same prescription for all of them. We wanted to be able to file with the Secretary of Agriculture our schedule, but we ask for his approval of what we do, because we want the Government cooperating with us for what is the best for the farmer. So we have provided in there that dam No. 3 shall be built as soon as there is need for it, and a new nitrate plant, by the most approved methods, shall be built, and we have put it that it shall be in the same relative capacity as the present dam No. 2 and the other plants, because our whole proposal is based on the division of costs between the Government and the lessee on the relative proposition of the power and the output of the nitrate plants, and so we put in that condition, so that if the Government wanted more of the power used than is then under the present dam, that is subject, then, to a new agreement or condition.

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In paragraph 5, "Locks and lifts," we offer to construct them at cost, and we offer to donate, in another paragraph, all of the power that is needed to operate them.

Paragraph 6, Senators, is very important. I will read it in full:

"6. *Manufacture of nitrates.*—When the two nitrate plants now a part of the property, which plants have an estimated capacity of 120,000 tons of ammonium nitrate per annum, have been redesigned and reconstructed as herein provided to manufacture such nitrates as are needed for commercial fertilizers, fertilizer compounds, or mixtures as approved by the Secretary of Agriculture, the lessee agrees to operate said plants under the following conditions: As soon as adequate hydroelectric power generated at Dam No. 2 becomes available lessee will commence to operate both plants and will continue such operation to the capacity they can be operated, after deducting operating expenses, from the receipts of the sale of"——

What we have done, Mr. Chairman and Senators, is to work out here a scheme for this plant to finance itself. We start on the theory that we can not make nitrates at first at a cost as low as the present selling price of Chilean nitrates. Every witness who has appeared before this committee or the House committee has said you can not commercially make these nitrates at a profit until we learn to improve the present processes for the fixation of atmospheric nitrogen. That has been the story, without any deviation. Now, we will accept that as true; then the only way that the Government can carry out the purposes declared in the national defense act is by subsidizing the making of nitrates until you can make them without losing money. That is what the Government did during the war. It subsidized the making of nitrates just like we will subsidize our merchant marine. Why? We say we need a merchant marine. We have got to sell our products to the rest of the world, and it is to our interest to do it under the American flag, and we can not do that at a profit, and therefore we will subsidize it for the good that will come to all our people. If it pays us to subsidize our merchant marine, then there are tenfold the reasons why you should subsidize the making of nitrates until we can learn to make them at a profit.

Instead of asking Congress, therefore, Mr. Chairman, to appropriate directly to subsidize the making of nitrates, we have worked out a plan to sell a part of this power and to use a part of the proceeds to make the plant finance itself. It will not take all the power produced at Dam No. 2 to run these nitrate plants. What we propose to sell is the excess power not needed to run these two nitrate plants. We will use a part of that money to finance the making of nitrates at a loss, but when we get where we make nitrates at a profit, then we will pay that money into the Treasury of the United States as rental on the lease.

The CHAIRMAN. That proposition is involved in paragraph 6 that you are considering now?

Mr. BUTLER. Yes.

The CHAIRMAN. It is difficult, Senator Butler, I think, to understand just what you mean on the thing you are discussing in your proposed contract. You say here (this is on page 4, about the middle of the top paragraph there), "as soon as adequate hydroelectric power, generated at Dam No. 2 becomes available, lessee will commence to operate both plants and will continue such operation to the capacity they can be operated, after deducting operating expenses, from the receipts of the sale of."

Then you tell what you are going to sell. Now, if after you made those sales, and deducting from the proceeds the operating expenses, there was not anything left, you could not operate the plant under that provision, could you?

Mr. BUTLER. Of course not, but that is not a supposable or possible proposition. We will operate——

The CHAIRMAN. To what extent is that a supposable or possible proposition? It does not mean, does it, that you are going to operate both of those plants to the full capacity, as at first blush one might get the idea you intended to do by this language?

Mr. BUTLER. We will operate to the limit of the fund thus created. It will work out practically this way: We propose to create a fund for financing the manufacture of nitrates, and by the sale of excess power only about half of the power at Dam No. 2 will be required to run these plants, and the other half we will sell. We will sell these nitrates and we will also sell the by-products not needed for fertilizers. This will create a large fund to be used as set out in subsection (a), (b), and (c) of paragraph 6, and this fund wil grow larger each year. But we have considered the possibility of this fund not being large

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enough in the beginning to run both of these plants at their full capacity, so we have added subsection (d), which is as follows:

"In the event said fund is not sufficient to operate said plants continuously, lessee will contribute to said fund for said purpose 20 per cent of its gross receipts from sale of power while such condition exists."

We do not expect to have to make such contribution very long, but we agree to do it, no matter how long it is required. Besides, a provision of this kind is the most effective way to cause the lessee to operate the plant in the most economical manner and to exert every effort to hasten the time when we can make nitrates at a profit. If we can do what we believe we can, that section is not going to cost us much money, but it may cost us a great deal.

The CHAIRMAN. You are going to deduct operating expenses from a fund?

Mr. BUTLER. Yes.

The CHAIRMAN. And you are going to operate as far as what is left will permit you to operate?

Mr. BUTLER. Yes.

The CHAIRMAN. And you will deduct from a fund the operating expenses, and that fund is going to be made up first of the sale of nitrates and fertilizer compounds——

Mr. BUTLER (interposing). Yes. It does not come in that order, but that is the way we wrote it. The first thing that comes will be the sale of power.

The CHAIRMAN. Another item of that fund will be 75 per cent of all the marketable by-products not required for the manufacture of nitrates or fertilizer compound. I wondered what that could consist of. What would that be?

Mr. BUTLER. At present it is not a very important item, but it will develop to be a considerable source of revenue before the end of this lease. There will be some revenue from the sale of by-products from the beginning, and in a few years we will be able to sell oxygen, which we can not sell until certain patents, which the Government has the right to use there only for the purpose of making nitrates, shall expire. We will have oxygen to sell from the beginning, but we are under contract not to sell it during the life of the patents. Those patents run out in 1931, do they not, Major Burns?

Major BURNS. I think it is in 1931 that those patents expire.

Mr. BUTLER. In nine years the patents will run out, and that will give us the right to sell every pound of oxygen produced. To-day all the oxygen left from water we throw away when we take the hydrogen from the water; and the oxygen left from the air we throw away, when we take the nitrogen from the air.

There will be other items, including carbide, as I said before. There is always some by-products.

The CHAIRMAN. In making carbide, for instance, you would not be manufacturing any oxygen, would you?

Mr. BUTLER. No.

The CHAIRMAN. What I mean is you would not come into conflict with any patents?

Mr. BUTLER. No. There are no patents in the way except as to oxygen.

Senator HEFLIN. What would you do with plant No. 1 at Muscle Shoals?

Mr. BUTLER. We would redesign it and put all the improvements that would need to be put in it. There are many changes which would have to be made. You would have to very largely rebuild it, because we will not only put in the new catalyst that Major Burns has described, which was an absolute failure in the present plant; but we will tear out that coke and water process for getting the hydrogen from the water and put in the electrolytic cell, and we will take out the machinery and process for taking the nitrogen from the air and put in a liquid air process. It would mean very largely rebuilding the plant to make it the most effective plant in the world, and we would use all of the means we know of up to date.

Senator HEFLIN. What did that plant cost?

Mr. BUTLER. It cost, in round numbers, offhand, about $13,000,000.

Senaor HEFLIN. How much of that value could you save in reconstructing it?

Mr. BUTLER. It is difficult to say, but we know that many changes will have to be made, and the estimated cost runs from $1,500,000, the lowest estimate, to $4,000,000, the highest estimate. General Williams and Major Burns place the figure at about $4,000,000, and we believe that it can be done for that amount or less. The greatest defect in that plant when it was built was the want of an effective catalyst. But in redesigning it now, we will tear out the coke and water apparatus for separating the hydrogen from the water, which

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is now being used by Germany and also by the small plant at Syracuse, N. Y., and put in the electric apparatus for doing this. We will put in the large electrolytic which has been developed by our War Department since the war, which is the most effective agency to-day known for securing hydrogen by electricity. We will also take out the apparatus for taking the nitrogen from the air and put in the liquid-air method. This, with the new catalyst, will not cost more than $4,000,000; and that is the outside figure.

Senator HEFLIN. Which would make the Government's expenditure not over $17,000,000?

Mr. BUTLER. Yes; including the war cost and everything. Then we would have a plant that would be the last word in the art and the most efficient plant in the world. The Haber process is the best and cheapest, and this will be the best Haber process plant in existence. Therefore we will be able to make nitrogen for fertilizers at Muscle Shoals cheaper than Germany or anyone else can make it to-day. Indeed, we may, with all these improvements, be able to make nitrates at a profit in this plant No. 1 from the beginning. And if so, then this plant should at once be enlarged.

The CHAIRMAN. We will have to adjourn at this time until 10.30 to-morrow morning.

(Whereupon, at 12.30 o'clock p. m., the hearing was adjourned to 10.30 o'clock a. m. Saturday, April 22, 1922.)

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MUSCLE SHOALS.

SATURDAY, APRIL 22, 1922.

UNITED STATES SENATE,
COMMITTEE ON AGRICULTURE AND FORESTRY,
Washington, D. C.

The committee met, pursuant to adjournment, at 10.30 o'clock a. m., in room 224, Senate Office Building, Senator George W. Norris (chairman) presiding.

Present: Senators Norris, Capper, Gooding, Ladd, Kendrick, Harrison, and Heflin.

The CHAIRMAN. The committee will come to order. You may proceed, Mr. Butler.

STATEMENT OF HON. MARION BUTLER—Resumed.

Mr. BUTLER. With reference to the coal deposits near Muscle Shoals along the Tennessee River, discussed on yesterday, I called up the Geological Survey and was informed that they have maps, Mr. Chairman, and data showing the deposits of coal along that river, and that there is an abundance of coal of good quality between Muscle Shoals and Chattanooga available for water transportation down to Muscle Shoals. So there is no question about the availability of a good quality of sufficient coal necessary to supplement the hydroelectric power with steam power, during the low-water stages to produce the maximum amount of nitrates at the least cost.

This coal will be in the position of bidding for our orders, so we will be able to buy it on the most favorable terms. Besides, we might decide, with the approval of the Secretary of Agriculture, to shut down one of these plants during the low-water period, if we could not buy this coal at a reasonable price. Under paragraph 6, we provide for a fund to be used in financing the production of the largest amount of nitrates at the least cost. It is simply a question of how best to use that fund to lower and stabilize the price of nitrates for fertilizers. If the cost of coal is too high to enable us to use it to run full time, then we should not buy it. To be able to take this position will bring the price of coal down to at least a reasonable price.

The important thing is not only to make nitrates, but to be able to make and sell them so as to stabilize the price to agriculture. Now, let us suppose that the Secretary of Agriculture shall decide that he wants us to sell nitrates at $10 a ton less than the selling price of Chilean nitrates; and we should show him that our fund would not be sufficient to buy coal for the whole dry period to produce 230,000 tons and sell the same at that large a loss per ton, but that, if we cut out the coal bill for one or two months we could then produce 200,000 of nitrates and sell all of this amount at $10 a ton below the price of Chilean nitrates; then the question to be determined is which policy will best produce the results dsired. In short, the question will be, shall we make 230,000 tons and sell it at, say, $5 a ton below the price of Chilean nitrates or shall we make 200,000 tons and sell it at $10 a ton below such price? That whole question will be determined when we go to the Secretary of Agriculture to agree on the price at which we shall sell the nitrates.

This, of course applies only to the period when we have to sell nitrates at a loss. When we have to make the nitrates at a profit or at a cost low enough to be fixed as the selling price, then none of the fund derived from the sale of

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power will be needed to finance the making of nitrates, and all of that fund will then be paid into the Treasury of the United States as rental on the lease. Thus you see that this proposal has been so framed that the all-important question of how to make nitrates and sell the same below cost until we can learn to make them cheaper will work itself out in a way to produce the best possible results. In short, this form of lease will enable that property to finance itself and produce most benificent results, even under the most unfavorable conditions, which will be at the start.

I call your attention in this connection to the testimony of General Barden on this point. He estimated that the additional cost for coal during the three months of low water, when we will not have enough hydroelectric power to run the plants but must supplement it with steam power, will be $600,000. That is an enormous item. That is larger than the total cost of running the hydroelectric plant for the whole year. Indeed, it is twice as large, for the whole cost to run the hydroelectric plant for a year will be only about $300,000. Obviously it is of the greatest importance to cut down in every way possible that enormous coal cost. We all know that it will be prohibitive to use coal all of the time, and to the extent of time that we are forced to use it it will add enormously to the expense.

So the coal is, in the beginning, a most important question; and that is why I emphasized on yesterday the great importance of building as soon as possible at the most available sites storage dams up the river, and thus increase this hydroelectric power, which would be a permanent and perpetual investment. This is a pure business proposition—the investment in these storage dams as against the cost of coal.

When we closed yesterday we were discussing the typewritten amendment, subsection (b), under paragraph 6; but before proceeding with that, I wish to refer to the typewritten amendment at the bottom of paragraph 4, which I overlooked yesterday, and which logically comes first.

The Warrior steam plant would be very desirable to be used in connection with this lease; but, eliminating that, we have added this amendment:

"*Provided*, That if the Warrior steam plant is not included in this lease, then the Government interest in the same shall be sold and the proceeds used to enlarge and equip steam plants Nos. 1 and 2 at Muscle Shoals, and the balance of said proceeds shall be turned into the fund for financing the production of nitrates and fertilizers, as described in paragraph 6."

If the Government sells its interest in the Warrior plant, estimating that it could be sold for 60 per cent of the amount invested, it would get for its interest around $3,000,000. The cost of completing and enlarging these two steam plants to take the place of the Warrior plant would be, it is estimated, about a million and a half.

Have you made any estimate on that, Major Burns?

Major BURNS. I do not recall ever having made any such estimate.

Mr. BUTLER. We think that is conservative. Therefore, out of the proceeds of the Warrior plant, without any appropriation by Congress, we can equip these steam plants up to date to their full capacity, adding 35,000 horsepower to their present capacity, and then have a million and a half dollars to go into this fund for financing the production of nitrates provided for in section 6.

That operating fund is made up from the sale of nitrates and fertilizers—all of it goes into the operating fund—from 75 per cent of the proceeds from the by-products, and from 66⅔ per cent of the proceeds from the sale of excess power not needed to run these plants. It is believed that this fund will be more than adequate, except at the beginning. To cover that period we have added subsection (d). Under this the lessee will contribute one-fifth of its gross income to that fund as long as the same may be necessary to run both plants at full capacity. We do not expect to have to do that long, yet we put it in to back our judgment and to show our good faith, and, further, as the strongest possible inducement that could be written into a contract to cause us to operate that plant just as economically as it is possible and to develop the art of the fixation of atmospheric nitrogen so as to make the manufacture of nitrates at cost, or less than the cost of Chilean nitrates, at the earliest possible date, because when we can do that we will never have to contribute, and until we do we will have to contribute.

In this connection it should be noted that lessee agrees in paragraph 15 to advance all the money necessary to operate this plant until this fund is created as provided in paragraph 6.

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It seems to us, therefore, that we have put into this contract every safeguard possible for the Government, and everything that would be an incentive and lash to spur on this company to produce the best possible results.

Also in paragraph 6, the last sentence, it is provided that when Dam No. 3 is built, that 75 per cent of the proceeds of the sale of excess power shall go into that fund instead of 66⅔ as provided in the case of dam No. 2. We feel that we can safely do that, because the overhead expense is going to be less as we operate more dams and more nitrate plants under the same management. So when that dam is built, the amount that will go into that fund for the financing of the production of nitrates will be materially increased, and to the same extent the revenue to the Government will be increased when that fund is no longer neeeded to cover loss in the manufacture of nitrates.

Our proposal contemplates the ultimate development of this whole river, and the adding of new nitrate plants as fast as new dams are built, or as fast as storage dams are constructed to increase the efficiency of the hydroelectric power plants, so that when the whole 1,000,000 horsepower of this river is developed that the whole proposition will be devoted to producing nitrates and nothing else. And before that can be done there will be a demand in this country for more nitrates than can be produced by the whole development. So we have provided in another paragraph that when this river is fully developed, if there is a demand for still more nitrates, that we will build other dams and operate other nitrate plants on other streams under the terms of this lease.

Paragraph No. 7 is the alteration of the nitrate plants. It is admitted by everybody that both of these plants can be easily changed to produce the kind of nitrates needed for fertilizers, and, at the same time, hold them in stand-by condition to make nitrates for explosives when needed. It will cost about $3,000,000 to equip nitrate plant No. 2, and it will cost about $4,000,000 to equip nitrate plant No. 1. We will not only change this plant to make nitrates for fertilizers, but we will put in three important improvements on the Haber process, which I explained yesterday, and which will make it superior to any other plant for the fixation of nitrogen. It will be more efficient then any Haber process plant in Germany and more efficient than the plant at Syracuse; and all that can be done for $4,000,000.

Senator GOODING. The complete plant?

Mr. BUTLER. The plant has already cost $13,000,000, but these changes can be made for $4,000,000. It is a small plant. The reason that it is so small is because we did not know much about the Haber process and we built it on an experimental basis, to see if we could work it out. We did not know the catalist that was used in Germany. Indeed we knew very little about the process.

Senator GOODING. Yes. I heard you say that, Senator.

Mr. BUTLER. Therefore, we built it on a small scale, on the unit plan, with the idea of doubling or trebling it. Is that correct, Major Burns?

Major BURNS. I never heard that.

Mr. BUTLER. Well, you made it small because it was experimental.

Major BURNS. That is correct.

Mr. BUTLER. So it was purposely made small, because it was an experiment, and it is easy to double it or treble it, if it is a success.

So while it is a small plant, the thing to do is to equip it with all improvements and to prove how cheap we can make nitrates. We know that we can make them cheaper by the Haber process than by the cyanamid process. There will probably never be another cyanamid plant built in this country or in any other country in the world. Germany is not building any more cyanamid plants; all her new plants are by the Haber process. She is using some of her old plants, but she made last year only a hundred thousand tons of nitrogen by the cyanamid process, while she made 300,000 tons by the Haber process. She got only about one hundred thousand tons from her coke ovens, and that is more than we got from our coke ovens, and yet we are not making a pound of nitrogen from the air.

So we should not scrap nitrate plant No. 1, but we should redesign it and put it to work. Everybody expects the improvements in the fixation of nitrogen from the air to come through the Haber process. As soon as we show what we can do with plant No. 1, we should build more Haber process plants.

Senator KENDRICK. You have suggested right there the great advantage in the Haber process over the cyanamid process. Is there any possibilty of changing the cyanamid process to the Haber process without entirely junking the original plant?

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Mr. BUTLER. No. The processes are entirely different, Senator, so much so that there is no way of changing one to the other. If we do not continue to use nitrate No. 2 as a cyanamid process for making nitrates for fertilizers then it might be used to make carbide, or something else. There are a number of things you can make in a cyanamid plant. A number of them that are in existence are not going to the point of making nitrates for explosives or nitrates for fertilizer. They produce other things at various steps. Some make and sell oxygen, carbide, and so on.

The CHAIRMAN. We could not sell oxygen unless we make some kind on an agreement with the patentee of the process.

Mr. BUTLER. It will be 1931 before we can sell oxygen unless we pay a royalty on the patents.

Senator GOODING. We are not going to do that, are we, Senator?

Mr. BUTLER. Certainly we will not unless it will pay.

I have heard it suggested that Congress should appropriate the money to finish the dam, and wait until the dam is finished before leasing the property. That would be a mistake. The work of redesigning those plants should begin when the work is started on finishing Dam No. 2, in order that the plants may be equipped and ready to operate by the time we have the hydroelectric power ready. Otherwise there will be much delay. It will take as long to get the plants ready to operate as it will to finish the dam. Shall we finish the dam and then let the water run to waste while we are redesigning the nitrate plants. That will be bad business, and besides it will delay the time when we will be making cheap nitrates. This lease should be made before the beginning of the dry-weather period beginning with August. It will take three dry-weather periods to finish that dam, so if we miss this year's dry-weather period, it means a loss of a whole year. That is your estimate, is it not, Major?

Major BURNS. Colonel Barden has done that, sir.

Mr. BUTLER. Colonel Barden has, I think, pointed out that it would take three low-water periods.

Senator GOODING. How long do those low-water periods extend over each year?

Mr. BUTLER. They begin along in August and run through October. Something like three months, is it not, Major Burns?

Major BURNS. That is substantially correct. They begin in the summer and they do not end until upwards of December.

Senator KENDRICK. Do you not prosecute the work during other months, Major Burns?

Major BURNS. As I understood the testimony of Colonel Barden, there is some of the work that you would undoubtedly carry on during the high-water periods, but the big bulk of your work would be done during the low-water periods.

Senator KENDRICK. Then, your time of actual construction is confined to a period of four months?

The CHAIRMAN. No; I would not say that, Senator. Of course, Major Burns is not connected with that part of the work. He has nothing to do with the construction of the dam. They work the whole year through on the dam. There are parts of it, as I understand it, the part that is under the water, that they can only work on during low water.

Senator HEFLIN. They construct their cofferdams while the flow is small.

The CHAIRMAN. While the river is low.

Mr. BUTLER. They work the whole year, but we must have three low-water periods to do the work that must be done under water or we will be more than three years finishing the dam.

The CHAIRMAN. Yes; that is true of that part of the work. They do that during the low-water period.

Senator GOODING. Tell me what is your high tide. You have a period of flood tide, don't you, when the river is high?

Mr. BUTLER. The flood tide is in the spring, I think, around the spring equinox.

Now, if you are going to give us this lease we want you to do it before August so that we can use the whole dry-weather period this year. And if the Government is going to finish that dam, then get your engineers down there before August for the same reason. We are ready to lease the dam after the Government has finished it or we are ready to build the dam under our lease.

Senator HEFLIN. You mean you will construct the dam and the Government furnish the money?

Mr. BUTLER. Yes. We will construct the dam for the Government or we will lease it after the Government has finished it. In section 19 we offer to do it,

with the Government furnishing the money, or we offer to lease it after the Government has finished it. Somebody has got to finish it or we can never run these nitrate plants.

Senator HEFLIN. You do not suggest you will furnish the money and the Government build the dam?

Mr. BUTLER. No. We are not proposing to take over the title to this property, so that the Government will have to reclaim it at the end of 50 years by paying us for it. This is the only proposition before you which does not even take over the title to any of the Government property. We have proceeded on the assumption that the Government wants to lease this property to someone who will best carry out the purposes of the national defense act. If we are going to reverse that policy, then let us say so, and be done with it; if not, then let us proceed with it by leasing this property to someone who offers to devote the whole project to making cheap nitrates, or have the Government to do it. But, certainly, the Government should keep the title to this property.

Senator GOODING. Your thought is that the people would be best served by the Government having the ownership there?

Mr. BUTLER. Certainly. It is very important for the Government to keep control, and if it keeps control, then, why should it not keep title? This property, if operated under a lease like we propose, will be of tremendous value at the end of 50 years and will still be the property of the United States. In the meantime it will have been used to perform the greatest possible service to the public. Now, shall we follow that course or shall we scrap this valuable property, abandon a great public service, and turn it over to a private monopoly to be used for private profit? When you do that, you will be giving a subsidy to one man to compete with all other private citizens in the same line of business. I submit that such a use of public money is indefensible from every standpoint.

The important thing here before you is not who gets this lease or who gets this property, but what is going to be done with it. That is a thing of tremendous importance.

Senator KENDRICK. I think it is highly important to know just how they get it.

Mr. BUTLER. Yes; how you get it and what you are going to do with it after you do get it.

Senator KENDRICK. I agree with you in the thought that there should be no alienation of title, even conditional transfer.

Mr. BUTLER. The Government must retain the title to all of this property if we are going to get the results contemplated under the national defense act. Besides, there should be kept the strictest control over the operations of the lessee. The contract of lease should be so drawn as to make it to the financial interest of lessee to exact every effort to develop the art of the fixation of atmospheric nitrogen and to produce the largest amount of nitrates at the lowest possible cost.

We have tried, Mr. Chairman and Senators, to draw a proposed contract that would do that very thing, and I want to say right here, if we have failed in any respect in making this contract clear and positive to that end, then we are ready to amend it to make sure of such results.

Senator GOODING. Senator, unfortunately I have not been able to be with the committee during much of this discussion, but there is one question that, if you have not been asked or if you have not explained and if it is not breaking in too radically on your line of thought at this time, I would like to ask. As I understand it, you are very familiar with conditions in the South. That is your home?

Mr. BUTLER. Yes.

Senator GOODING. And you understand soil conditions down there?

Mr. BUTLER. Yes. I was born and raised on a farm and have been farming all my life. I have one of the largest farms in my State.

Senator GOODING. Your thought, as I understand it, in connection with this, is that as far as the South is concerned—and they are a mighty important part of America; we all agree to that—the greatest blessings and benefits that can come out of Muscle Shoals will come from carrying out the original idea in connection with the manufacture of nitrates.

Mr. BUTLER. There is nothing so important to the South to-day as doing that. It is also of tremendous importance to the whole country.

Senator GOODING. As far as the industrial plants down there are concerned, which is, of course, a very important question, that, after all, is small as com-

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pared with the keeping up of the fertility of the soil. That is the first question that confronts every country, or should be, if it were given thought, but we haven't given, anywhere that I know of, with any degree of intelligent direction, any thought to that question. If we have, I have not been able to find it.

Mr. BUTLER. Unfortunately, that is too true.

Senator GOODING. I am unable to go to our great Agricultural Department here and find the exhaustion that takes place with the growing of different plants and crops that we have grown. They have not any such record down here. At least I have not been able to get it. So that is what you want to put on the soil—those things that plants exhaust.

Mr. BUTLER. A sufficient supply of proper plant food for the soil is a problem that I have been forced to study all my life; I have had to do it from financial reasons, as well as from an absorbed and deep-grained interest in the success of agriculture. I have had to work that problem out on my own plantation with such help as I could get from the Department of Agriculture, but largely from my own experience. Of course, they have given a great deal of valuable assistance, and I have, in my——

Senator GOODING (interposing). Yes; they have done good work.

Mr. BUTLER (continuing)—feeble way, helped to direct some of the investigations along that line, both when I was in public life and in private life; and, I am glad to say that the activities of the Department of Agriculture are broadening and are becoming of more use all the time.

Senator GOODING. I agree to that; but the one great thing in this country that we have not studied as fully as we could and should is the soil exhaustion that is taking place all these years.

Mr. BUTLER. That is one thing of very tremendous importance that has not had the attention from anybody that it deserves. I agree with you that our Agricultural Department does not seem to be fully alive to its importance.

Senator GOODING. I say that advisedly, because I have been a farmer all my life.

Mr. BUTLER. Crops can not be successfully grown on a soil unless it contains the essential plant foods, which are nitrogen, potash, and phosphorus. Nature has stored up a certain amount of these plant foods in most soils, but not always in the proper proportion for the crop you may desire to raise. The shortage must be supplied to suit the crop to be raised. But this supply of plant food in our virgin soils soon becomes exhausted and must be supplied in the form of fertilizer. The most important one of these plant foods is nitrogen. It is the scarcest and the dearest. There is no known source of sufficient supply of nitrogen except from the air. We must get it from the air or our soils will grow poorer. The soils of the South and East have long suffered for want of nitrogen. But the soil in the West is beginning to be exhausted also. Take Senator Ladd's State, which we were discussing yesterday, where they are producing to-day in the richest soil in this world only about half the wheat that they were producing 20 or 25 years ago.

Senator GOODING. Yes. I heard that statement.

Mr. BUTLER. That is because the plant food is being taken out of that soil and it is not being put back. They are facing the proposition rapidly that unless they use more fertilizers, unless they can get cheap fertilizers to put the plant food back, they will soon be where we are in the South. The condition is a serious one, and it is facing every part of the country. The East and the South have faced it longer than the West, but the West is fast approaching it.

So we have here to-day a proposition that is vital to every State in the Union. It is basic, and our prosperity, our increased new wealth each year is measured and limited by just how much plant food we can put back in the soil and how cheaply we can put it there—not only the prosperity of the individual farmer, Senator, but the great mass of consumers.

Senator GOODING. Sure.

Mr. BUTLER. I can not go on producing food and clothing from my soil if my expenses, including high-priced fertilizers, are greater than what my products will sell for. That means higher prices to the consumer, without any benefit to me or benefit to the country. It means lesser production, which means loss and waste to everybody. It means loss even to the fertilizer companies, because we will buy less fertilizer. We used only 5,000,000 tons in this country last year when we should have used 10,000,000 tons.

Senator GOODING. I bring that out because it seems to me that there is a thought, as I gather it, to get away from that and think of this only as a

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development of industrial plants in the South. There is too much of that, I believe.

Mr. BUTLER. It would be a shocking thing to turn that great water power and that large investment of public money over to a private monopoly for private manufacturing schemes. With the great mistake made at Niagara Falls it will be inexcusable to make the same blunder at Muscle Shoals. To turn this water power over to a private monopoly will not deprive agriculture of a sufficient supply of nitrogen, which is so sorely needed, but it will deprive the people and the industries around Muscle Shoals of an opportunity to buy light and power.

Take the city of Buffalo as an example. The people of that city can not buy one kilowatt of power or light now from the great source of supply at Niagara Falls. We all remember that one morning we woke up and saw in the headlines of the newspapers that electric power and light had been transmitted 28 or 30 miles from Niagara Falls to Buffalo, and what a wonderful feat it was, because before that time we had not been able to carry it more than about 15 or 20 miles. We have learned now to carry it 250 miles, and it will not be long before it will be carried a thousand miles. That electric current was sold for a while, but there was no restriction on the business, so that private monopoly soon began to use it for private profit in private manufacturing. Then Buffalo had to spend $10,000,000 putting up a steam plant to make light and power, and in the most expensive way. With all that great water power there the country right in and around there is starving for light and power. If you do this same thing at Muscle Shoals you will have every farmer and every industry and all the people around within 200 or 300 miles starving for light and power. You will put them in the plight of Tantalus's condition of standing in water coming right up to his lips, yet thirsting to death because he could not get a drop to drink.

The CHAIRMAN. Do you know what they have to pay in Buffalo, the ordinary consumers, for electricity?

Mr. BUTLER. I do not.

The CHAIRMAN. Do you know what they pay on the other side of the river, in the Province, where the Province handles the electricity?

Mr. BUTLER. I understand it is much cheaper.

The CHAIRMAN. That is the understanding I had, but I have before me here a report made by Murray and Flood, comparing the cost of electricity over there and on the American side. I have not read the thing itself, but last night I spent two or three hours reading a review of it. It is claimed, I judge, by these people that they are paying more for electricity on the other side, where the Government handles it, than they do on this side, where it is all handled by private parties. I was wondering if that was true?

Mr. BUTLER. There may be special cases under special conditions where that happens, but I doubt it.

The CHAIRMAN. In the report that I read, that was a fair synopsis of this report, they took the whole country and compared the average cost all over the country.

Mr. BUTLER. If it is so, it should not be.

The CHAIRMAN. Do you know that the people of Buffalo are supplied with electricity generated from a steam plant?

Mr. BUTLER. Yes, sir. They spent $10,000,000 recently enlarging their present plant. It cost them $10,000,000 to supply the power and light.

The CHAIRMAN. I am going to make some investigation of that point. I doubt the report very much.

Mr. BUTLER. The State of New York is now trying to change that condition, so that Buffalo and other people in that circle around there——

The CHAIRMAN (interposing). Will get the benefit?

Mr. BUTLER. Yes.

Senator HARRISON. I do not know what the situation is to-day, but some four years ago, and for years prior thereto, the Foreign Relations and Foreign Affairs Committee of the House investigated the question of the utilization of power at Niagara Falls, and in the consideration of that question they went into the rates that were charged on the Canadian side as well as on the American side, and the facts were at that time the rates were much cheaper.

The CHAIRMAN. On the Canadian side?

Senator HARRISON. They were much cheaper on the Canadian side than on the American side, and all the municipalities were very much interested in

the question and were protesting against the high rates they were being charged on the American side.

The CHAIRMAN. I was somewhat familiar, Senator, with that investigation, in a general way. I know what you say was the outcome of it, and that is one reason I was very much surprised when I read the synopsis of the Murray and Flood report last night, printed in a magazine, wherein it was claimed that the Canadians in Ontario were paying a great deal larger price for electricity than the Americans were on this side.

Mr. BUTLER. Of course, it now costs more in Buffalo to generate the light and power than it would from water power.

The CHAIRMAN. It certainly does if they have to do it with coal.

Mr. BUTLER. It costs more than it does to generate it at Niagara Falls.

The CHAIRMAN. It certainly does, because that is one of the greatest water powers in existence to-day.

Mr. BUTLER. If that condition exists, there is some abnormal or unjust reason for it.

The CHAIRMAN. This report, as I judge, has for its purpose the demonstration of the fact, or supposed fact, that the reason it costs more is that Ontario is a government and it is government ownership.

Senator HARRISON. Who are these people that make that report?

The CHAIRMAN. Well, they are some electrical engineers.

Senator HARRISON. May I ask you, Senator—perhaps you stated it when I was not here, but as one member of the committee I naturally, if the Government is not going to do this work, would want to know the character of the people who are making the proposal, or their ability to do the work that they propose to do, and what they have done in the past, and whether they have been successful or not. I notice that this proposal is made by Mr. Engstrum, and he proposes to form a corporation to do this work, under your proposal. You have done nothing yet toward perfecting the corporation, as I understand.

Mr. BUTLER. We have not announced our organization, but we are ready to form a corporation and will do it before this contract is signed.

Senator HARRISON. What is to be the capitalization of the corporation?

Mr. BUTLER. The capitalization will be two and a half million. That is certainly sufficient protection for the Government under this lease.

Senator HARRISON. Have you any assurance that you could sell the stock?

Mr. BUTLER. We may not have to sell any stock. We think that the proposed company can put up the necessary money. We will organize a company with a capitalization big enough to convince the Government and everyone that we have financial resources in sight sufficient to do everything we agree to do. We are not buying anything. We are offering to lease a property and operate it under conditions that would make it finance itself. We have worked out a scheme for selling a certain amount of excess power for that purpose. We can finance this proposition by the sale of excess power and make nitrates at a loss, if necessary, without making it necessary for Congress to vote a subsidy to finance the making of nitrates. We also agree to put up sufficient money to run this property until we can finance it in this way: None of us would live through the lease, probably, and therefore it is a corporation, and we have got to tie it up—but outside of the characters of the men who start that it has financial responsibility to do all we promise to do and obligate ourselves to do. We give a bond also for the faithful performance of this contract.

Senator HARRISON. How much bond?

Mr. BUTLER. Any size that the Government requires. We put no limit on it.

Senator HARRISON. Who is associated with Mr. Engstrum?

Mr. BUTLER. We have not asked the permission of any of our associates to announce the personnel of the company. We have negotiated with enough people to know that we can form a company of two and a half million and give the bond and put up the amount of money that is required under this proposal.

Senator HARRISON. I ought to know Mr. Engstrum, but I do not. What has been his experience?

The CHAIRMAN. He went into that quite fully yesterday, Senator.

Senator HARRISON. Oh, did he? All right, I will read it in the record.

Senator GOODING. Very fully.

Mr. BUTLER. The fact is that no one who has made an offer for this project is better qualified by ability and experience and in every way to develop and operate the Muscle Shoals project than Mr. Engstrum, as you will see when you read his record.

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Senator HARRISON. I will read that in the record. I did not know that you had covered that.

Mr. BUTLER. I asked the permission of the committee for Mr. Engstrum to go on the stand and state briefly what his experience has been, which has been as an engineer and contractor all of his life, and his father before him. It is in the blood, if you please. Trained engineers and contractors, and the family themselves of large means and very successful. The fact is that Mr. Engstrum himself, individually, could finance this proposition.

Now, Senator Gooding, I want right here to answer further your question, because it is basic. I feel if we all could get squarely before us the picture that you had in mind when you asked the question that we would take action on Muscle Shoals and that it would be the right action. We are blindly driving our high-class wealth producers from the country to the cities. We are starving our soil. You can not expect the men of the fiber of our ancestors to stay on farms, though born and raised there, and continue to exhaust their efforts and grind out the lives of their wives in drudgery and not make a decent living for their families; the result is we are driving whole families from the farm, the men and women who have produced the high-class boys and girls—the fresh blood from the country which has kept the cities from rotting. It has been the country-raised boys who became leaders of the next generation. We do not produce many high-class men in cities. They play out. The conditions are not of the right kind. It is the country that is the fountain spring of a high-class citizenship, which is the cornerstone of every country and the very bedrock of a republic, where we are supposed to govern ourselves. We are drying up the fountain springs of the next generation by driving that high class of citizenship from the soil. And the rate is growing rapidly; it is a matter of grave concern. If we go back and begin to quote what history shows, it sounds stale; but I tell you, Senators, we ought to stop and look square in the face what has happened to every other country that has driven its high-class farmers from the soil.

Senator GOODING. It is happening here, Senator.

Mr. BUTLER. Yes; and it is happening here faster to-day than it has ever happened in the history of any other country of the world. In what is falsely called the "Golden Age" of Roman civilization Emperor Augustus saw the growing migration of Rome's wealth producers from the compania and other productive districts to the cities. He saw the danger of that migration to the future glory and prowess of imperial Rome. So he summoned Virgil, the most beautiful and persuasive writer of his time, and asked him to write a series of articles on the beauties of country life and to appeal to the farmers to go back to the soil and continue their work of the production of food and clothing and also the raising of sturdy country boys to replenish the fighting legions of the Roman Empire.

The result was Virgil's Georgies and Bucolics. But history tells us that those glowing pictures of country life, set off with all the beauties and embellishments of poetry, did not send a single farmer back to the soil and did not in the least stop the fatal migration. That was the beginning of the end of the prowess of Rome. The Emperor Augustus saw the evil, but he did not see the remedy, because he did not comprehend the real cause. The beautiful pictures of country life could not induce the Roman farmers to go back and face again a fate of unrequited toil.

Senator GOODING. I am accumulating a record of the farms abandoned in the different States of the Union at the present time. It is really appalling to see what is happening in many of them—almost all of them, as far as that is concerned.

Mr. BUTLER. Take a high-class family, a father and mother who had raised 8 or 10 children, educated them as best they could; when that father and mother passes away not one of the boys will remain on that farm. Then we have the tenant or an abandoned farm.

Senator KENDRICK. Don't you believe, on the other hand, Senator, that the chief difficulty on the farm is that the advantages in the way of compensation in the industries and in the cities particularly is claiming and are claiming the better talent from the farms every year and leaving only those who—or leaving at least a smaller and smaller proportion of men capable of making a success of farming?

Mr. BUTLER. Exactly. If anyone out of a family of 8 or 10 boys is left on a farm, it is always the one who has not got nerve and initiative enough to leave. But they all know farming better than anything else, and they would all stay if there was a decent living in it.

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Senator HEFLIN. Not only that, Senator, but the price of fertilizer that the farmers have to use is so high that it is difficult to make a profit on farming operations.

Mr. BUTLER. Of course; there is the root of the trouble.

Senator HEFLIN. Take my State. In 1920 the cotton crop amounted to about 600,000 bales and brought an average price of 10 cents a pound, making $33,000,000. The fertilizer bill that year for my State was $20,000,000. The fertilizer bill of some of the farmers was more than they got from their crop—many of them, for I know many of them, and they are good farmers and not men who throw away their time and effort.

Mr. BUTLER. That situation, Senators, is one to-day demanding the first attention of every statesman of this country; namely, how to stop that migration from the farms. You may preach all you please, you may offer all you can in the way of palliatives, but you will never stop the migration until we make farming profitable and the lives of the wives and daughters raised on it more comfortable, and that can not be done without some decent revenue from their work. They toil 16 hours a day and get nothing but more toil and drudgery.

Senator GOODING. Drudgery all the time.

Mr. BUTLER. It is continuous toil and drudgery, and they do not get enough money to make themselves decently comfortable in their homes, with sufficient clothing and the ordinary comforts of life, to say nothing of education and self-improvement, which our civilization demands.

To-day, with our rural telephones, rural free delivery, good roads, and with automobiles, if we could only make farming more profitable we could hold and build up a great class of farmers again, the very flower of our citizenship.

Senator GOODING. With your good roads and automobiles?

Mr. BUTLER. Yes; good roads, automobiles, rural free delivery, telephones, and better rural schools are all needed improvements and, to an extent, inducements, but they are not enough. You can not keep high-class people on the farm without you can make it more profitable. That is the one thing needed.

The CHAIRMAN. It will take more than fertilizer to do that.

Senator GOODING. It will take a little more than fertilizer.

Mr. BUTLER. Yes; I know that. I have studied every question affecting the success of agriculture and have helped as far as I could in providing the needed remedies. I have spent a great deal of time recently in helping to form cooperative marketing associations. We have the farmers in my State and in many other States already organized into such business organizations. That is one of the remedies.

The CHAIRMAN. Still, that is not enough.

Mr. BUTLER. No; that is not enough. The basic, the all-important question is to first be able to produce larger yields per acre and per man and at less cost. This must be done before any of the other things count. Here the question of cheap rural credits is as important as an abundant supply of cheap fertilizer. We must have a banking system suited to the needs of agriculture, with long-time credits.

The CHAIRMAN. What have you done about the railroads? What about transportation?

Mr. BUTLER. Transportation, of course, is a question of great importance to every business, and especially to the farmer, on account of the weight and bulk of what he buys and what he sells. I tackled that question when I was a member of the State senate of North Carolina and put through the law creating our railroad commission. I also got interest reduced from 8 to 6 per cent.

The CHAIRMAN. This is all very interesting, but I think we ought to get along with this contract, Senator.

Mr. BUTLER. Yes; and the cost of fertilizer is the one thing we have before us in this Muscle Shoals matter, and it is a tremendous item. Nearly every farmer I know has had his back broken with his fertilizer bill. If it had not been for the high cost of fertilizers nearly every farmer could have come out ahead during the last two years. If you can use Muscle Shoals to reduce the fertilizer bill, say, 33⅓ per cent, you will put a very large percentage of the farmers on their feet who to-day are broke. So we are tackling one of the live wires going to the very root of agricultural prosperity.

Section 8 covers plans for alterations of nitrate plants. We will submit to the Secretary of War and the Secretary of Agriculture our plans for redesigning and re-forming these plants, as already explained, and to be agreed on by their experts.

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Paragraph 9 is the research section. It is more important than the length of the paragraph would indicate. While the redesigning and the practical operation of these plants to make nitrate will be very useful in learning how to make nitrates cheaper, yet the operation of a research plant is the most important and surest way for this country to be the first or have an equal chance with other countries in developing this great art of the fixation of nitrogen. While other proposals before you propose to also run a research plant, but I submit that you can reasonably and logically expect greater results from a lessee operating a research plant, if he is devoting his whole time and effort to it.

If we were offering to use only one-tenth of this power for making nitrates, and nine-tenths of it for our private purposes, unregulated, certainly the making of nitrates would necessarily be a side issue, and we could not be expected, with human nature constructed as it is, to run a research plant with the same intelligent interest to produce improvements in the art, as if we were devoting our whole time to the making of nitrates and had hanging over us a contribution of 20 per cent of our income for that purpose, until we made a success of the enterprise.

The research plant will be our key joker there to make that thing a success, and I submit that only under such conditions as put out into this proposed lease, can you expect to get the best results from such a research plant.

Paragraph 10, about construction: We agree to begin the required construction there within a reasonable time, and to finish it within three years.

Paragraph 11, changes: This paragraph, and 12, 13, and 14, we put into the original proposal, when we thought we would offer to build this dam for a fixed sum. But with so much difference of opinion about its cost, we changed to the plan now proposed. We did not want to ask too much to build it, and if we offered to build it as cheap as we thought we could, we might be caught under our bond. We thought it was well to leave them, even in the changed form, because under a 50-year contract we are very much interested, as much so as the Government can be, in having this construction of the best quality and of the most durable nature, because, of course, we do not want anything to give way or break down.

Paragraph 14 provides for a representative of the Government engineers being on hand with our engineer to agree about what is to be done and how.

Paragraph 15, contains an important amendment. It reads as follows:

"The lessee agrees, however, to advance all the money that may be necessary for operating expenses until sufficient funds are received from the sources enumerated in paragraph 6; the said money so advanced to be reimbursed as soon as practicable."

Now, what that amount will be we can only estimate roughly. So we have put no limitation upon it. Under our bond and under our organization we do not expect, roughly speaking, it will require more than $250,000 to be advanced until we will have a fund that will comply with the terms of section 6; but if it should take $500,000 or more we are prepared to meet it. We have figured that it may take that much. It may take more, but we will form, as I said, a company with $2,500,000 capital, so there can be no question about the necessary money to run the plant. We agree to make this thing a success, and we expect to do it, and we can not make any money for ourselves without we do. One thing is certain and that is that the plant shall run. We agree to furnish the necessary money until we can earn it from the plant, and even after the plant is going if there comes a period during the year when we can not run on the fund created, we will contribute 20 per cent of our part of the receipts from the sale of excess power to do it. We think we have protected the Government from every standpoint, and also put in every stimulus that is necessary upon the lessee, but it is open to amendment. Men, who intend to do what they promise to do, do not object to binding themselves with the greatest particularity. Therefore, we are ready to make any reasonable changes desired to carry out this proposal.

Section 16, sale of products: There we agree to sell all of the products of every kind that are made, under terms to be approved by the Secretary of Agriculture. Attention is called to the provision at the end of section 16. It reads:

"It being understood and agreed that primary power may be sold and the nitrate plants may be operated by secondary power to the extent that the same can be done to assure the best financial returns for the operation of the plant and to produce a maximum of nitrates and fertilizers under this contract."

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Secondary power can be used to greater advantage in making nitrates and fertilizers, probably, than in any other way. To the extent that that can be done—with a view always of the results that we are to produce—it is desirable, because secondary power does not sell in the market as well as does primary power, and the more primary power we can sell the greater fund we create for financing the nitrates. So, up to the time when we can make nitrates at a profit, it is of the greatest importance that we should sell as much primary power as possible in order to create the largest fund for financing the loss. Of course, after we are making nitrates at a profit the amount of power we can sell and the price we get for it will determine the amount of revenue that goes into the Treasury on this lease.

Section 17, additional plants: That is the section to which I referred to a few moments ago. When this whole river is developed and there is more need for nitrates—we are in the business, we are experienced, we have a trained corps of experts—so we ask that we shall be given the opportunity, under this contract, of going to other rivers, other water-power sites, and developing similar work to supplement the million horsepower that will finally be developed at Muscle Shoals. There is nothing binding on the Government about it. But, of course, if we live up to our contract, we are the best people in the world to render that service.

Section 18, profit from nitrates: I will read that section:

"It is further agreed that when nitrates for fertilizer and fertilizer compounds can be made at a profit, or when the cost of the same has been so reduced that the funds arising from the sources enumerated in paragraph 6 are not needed in whole or in part for financing such productions as herein stated, the said funds not needed for operating expenses shall be paid by the lessee into the Treasury of the United States. When said funds paid into the Treasury shall be in excess of the amount received from sale of excess power, as described in paragraph 6, it is understood and agreed that during the period such conditions exist, fertilizers are made at a corresponding profit and the lessee shall be entitled to 25 per cent of such profit."

We feel that no one can object to us reaping 25 per cent on the profit from fertilizers when we get to making them at a profit—that is to be read in connection with another section—provided that the Secretary of Agriculture shall consent to our selling them at any figure above cost. Of course, if he does not, we get no profit. But the time may come when the Secretary of Agriculture will decide that we were making nitrates so cheap that we should sell them at 10 per cent above cost. Then we should have as a reward, if you please, for our effort in reaching that situation a share equal to one-fourth of the net profits.

It will be noted that the time when nitrates are made at a profit will be when the funds paid into the Treasury shall be greater than the amount received from the sale of excess power. That will mark a period of complete success; but it may come earlier than we expect on account of improvements in the Haber process. We may reach it within a year. Those developments in science and chemistry often come quickly; when you have a number of minds centered on one thing it is astonishing how similar discoveries and inventions come all over the world within a few months of each other. It is a most remarkable thing to see in the Patent Office how many inventions along a particular line come within a few weeks or months of each other. Some of the greatest lawsuits are as to the hour that A or B invented the same thing. To-day we have the minds of scientists in the world all concentrated on this thing—a cheaper process for the fixation of atmospheric nitrogen.

Section 19 gathers up all of the construction that we may do and that has been described above. I will read it:

"In consideration of the performance of the foregoing proposals and conditions the Government shall agree to pay to the lessee for the completion of Dam No. 2, the initial alterations of nitrate plants No. 1 and No. 2, the completion of the locks at Dam No. 2, the completion of steam plant No. 1 to a capacity of 10,000 kilowats and steam plant No. 2 to a capacity of 90,000 kilowats, and when required by the Government for the building of Dam No. 3 and nitrate plant No. 3 and the locks at Dam No. 3 and additional dams and nitrate plants and storage reservoirs"—

So the full development of the river is contemplated, you see—

"the actual cost of the same, respectively, together with a fee of 5 per cent on such cost in each case, in monthly payments, as per estimates of the engineers upon schedules of work performed. The cost in each case is to be determined by the lowest responsible bid resulting from a public offer by lessee and

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by the contract awarded by lessee to such bidder, subject to approval by the Secretary of War. It is understood and agreed, however, that if the Government shall decide to finish Dam No. 2 that lessee will accept a lease subject to that modification of this proposal."

That language is plain. I have read it simply because the whole construction proposition is there brought together.

The only question that could arise, I take it under that, is as to whether or not the 5 per cent fee is a fair one. Now, this is not a cost-plus contract as we learned it during the war, where everything was wide open and the inducement was to make everything cost as much as possible so the 10 per cent profit would be as large as possible. Anything here has to be submitted to a public bid, and it is the lowest public bidder, and then subject to approval by the Secretary of War. So we have learned by experience that this is the way to get the best constructive talent to bid against each other and get the lowest possible figure for construction of any kind from the most responsible men, with the privilege always of turning down all bids, of course.

The CHAIRMAN. It is not the contemplation that the lessee should actually do the work, is it? He is only to let the contract to somebody else?

Mr. BUTLER. No; and for this reason: While we could organize, of course, a construction company to do that, yet there are operating in this country a number of high-class contruction concerns of great responsibility and capacity, with highly equipped organizations, that are equipped with everything to do such work in the best and most efficient way, and of course in the cheapest manner. They can do the work cheaper than anyone else. But under our bond we would be responsible. We would make the subcontract with each one, and under our experts and engineers and under our direction all of this work will be done, and we are responsible for the result.

The CHAIRMAN. How much cheaper do you expect in this way you would be able to complete Dam No. 2? How much cheaper than if it were completed by the Army engineers, I mean.

Mr. BUTLER. Well, we have figured that we can do it cheaper than the Army engineers have estimated it, after the 5 per cent is paid us; but we put in that optional clause just so as not to argue the question. We are willing for the Government to finish it; there will be no profit in it for us.

The CHAIRMAN. Under your lease you would get the railroad and mixing machines and machinery, cars and engines, and would turn those over to your contractors who were successful in bidding, would you not?

Mr. BUTLER. Of course, any part of the equipment there that can be used by a contractor will come off of his bid, or would be taken as a part of it to reduce the cost.

The CHAIRMAN. For instance, the Government has 25 to 30 miles of railroad there. You would expect to get that under the lease, would you not? Your lease provides for that?

Mr. BUTLER. That road was built to be used in the necessary transportation of materials needed in the making of nitrates. Of course, we will need it and will use it under this lease for the same purpose.

Under our lease anything the Government has there will be utilized to the greatest extent that it can be used economically in the construction operation of the plant.

Senator KENDRICK. Senator Butler, my attention is called to the language here in section 19, and I find it difficult to determine from the paragraph as it reads where the right to limit construction lays, whether it is with the Government or with the lessee. The language reads that the Government, in consideration of the performance, shall agree to pay to the lessee, and then enumerates the different items involved in the construction of many different plants.

Mr. BUTLER. You will notice, Senator, that the construction is grouped in the same wording down to Dam No. 3. Those things enumerated above are what are in the present Government project, for which there are plans and specifications. We agree to go on and do these things, because they are provided for now. They are things the Government, I take it, will do itself if the property is not leased. There being no complete plans and specifications for Dam No. 3, we change the wording when we get there and state "when required by the Government." We take it for granted the Government wants everything above that done now. That is the purpose of all these hearings. The other things we are to do when required by the Government.

Senator KENDRICK. That statement places the limitation.

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Mr. BUTLER. With this lease approved, as worded, the only things authorized to be done under it are the things enumerated in that paragraph above Dam No. 3. The other things mentioned are subject to future authorization. They are the future developments. There will, of course, be three or four more dams and storage reservoirs built on that river and there will be at least one nitrate plant by each dam. We agree to do this work for the very moderate construction fee of 5 per cent on the lowest possible cost to be fixed by the lowest public bid. We feel we will be very lucky to come out whole on a 5 per cent fee. We have to furnish all the engineering ability and the supervision and take all the responsibility. Ordinarily an engineer competent to handle this work would charge that much or more. That is a very small fee for an engineer, and it is a very small figure, and really it is a question whether we would come out whole with that 5 per cent. And we feel also that we can do this work for the Government at less cost, including that fee, than the Government can do it—we will have in charge of this work the very best and the highest priced experts who can be found—we will pay these men much higher salaries than the Government would pay them.

The bill, Mr. Chairman, which you have pending before the committee limits the salaries for the commissioners to $7,500. That is as much as a Senator gets, it is true, but we would not employ a man for that whom we would put in a responsible position to get these results. We might lose a million dollars employing a man for $7,500, where a $25,000 or $30,000 man would save us a million dollars.

The CHAIRMAN. These $7,500 men provided in the bill have permanent positions. Don't you think that a man getting a position which, if he does his work right, would last as long as he lived, that $7,500 a year would attract the very highest class of men?

Mr. BUTLER. You may be able to get some high-class man without any special qualifications for any special thing for that, but you could not employ a chemical engineer, best qualified for that work, for any such sum. We will expect to pay from $20,000 to $30,000 for high-class experts, and it will be economy for us to do it.

The CHAIRMAN. Senator, the man that you would put in charge of it would not necessarily be a chemical engineer, because he would have under his charge, or this board would, speaking of the $7,500 men, three of them, trained men, capable of doing the work. There might none of them be engineers. I do not think it necessarily follows that they should be, but rather men who had great executive ability.

Mr. BUTLER. They would have to employ such experts.

The CHAIRMAN. Certainly they would. When they had a chemical problem they would have a chemist do it, and they would understand that. The men that operate and have charge of some of the greatest manufacturing establishments in the world are not engineers, and they are not experts in any certain particular line; but they have great executive ability. They have men under them that do it. They don't do it themselves.

Mr. BUTLER. You would have to take the limit off the men they employ. There is too much involved here to——

The CHAIRMAN. The limit on the men employed, under that bill, is $12,000. I don't think you would have to do it.

Mr. BUTLER. Not a single one of the experts whom we will employ under this lease can be employed for that figure.

The CHAIRMAN. Take the man—he is not here, and we can speak of him without embarrassment—Colonel Barden, who has charge of the construction of this dam. I think everybody that came in contact with him was impressed with his wonderful comprehension of the work that he is doing. He is an expert. He is getting the salary of a colonel. He might resign from the Army and go out and probably be one of the $25,000 men.

Mr. BUTLER. Yes, he might resign and get into that class at once.

The CHAIRMAN. He would at once, but he does not do it. He prefers to stay in the employ of the Government on the salary that he is getting, and he will probably stay there as long as he lives.

I happened to know—and I knew it because, I suppose, I was chairman of the Committee on Agriculture and came in contact with it—some of the best chemists the Government had, and I used to be interested in their work and used to talk to them about it. They used to come to my house in the evening, during the war, and we used to talk over their problems. I happened to know one of the

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best chemists that we had, and became very intimately acquainted with him, getting a salary, I think, of less than $3,000 a year. He was offered, while he was getting that, $10,000 by the Standard Oil Co., and refused it, and he continued to refuse it until the war was over. I don't know whether, since, he went with the Standard Oil Co., but he went with some private corporation finally when the war was over, and started in at a salary of $10,000 a year. He gave up a salary of probably $2,500 or $3,000. I happen to know, from talking with him, that this man would have stayed in the employ of the Government if he had been able to get a salary of $5,000. He would have stayed there for life; but his salary, living in Washington, with a family of growing children, and several girls in the family, he was not able to live on that salary that he was getting, and he wanted to save up something for his family, naturally, and he left.

I don't think the Government would have to pay the best men those fabulous prices. Personally, I don't believe there is a man living that is worth $50,000 a year anywhere, in any line, I don't care who he is.

Mr. BUTLER. He is if he produces you results that will save you millions of dollars.

The CHAIRMAN. Certainly, but you can get a man cheaper than that that will produce the same results. You know and we all know, those of us, at least, who are lawyers here, that the great lawyers of the country who are getting $50,000 or $60,000, their work is done, probably, by a clerk that is only getting $2,500 a year. About all the lawyer does is to sign his name.

Mr. BUTLER. But there is a wise head over him that O. K.'s it.

The CHAIRMAN. He signs his name on the dotted line, and that is about all he does. He has a reputation——

Mr. BUTLER. His name never goes on that dotted line until he knows and approves what the man under him has done.

The CHAIRMAN. Yes.

Mr. BUTLER. It is his name and his reputation that stands there to guarantee that the opinion is sound.

Senator, I have been surprised to find the number of high-class men in all branches of the Government service staying on at low salaries that could command larger ones outside.

The CHAIRMAN. Well, they would rtaher work for the Government.

Mr. BUTLER. Well, it is a sense of loyalty, in a way.

The CHAIRMAN. Yes, it is.

Mr. BUTLER. A man who has graduated at West Point or Annapolis feels that the Government has given him his education and that he does not want to be a slacker and jump out when he can get more money somewhere else, and it is only when the time comes that he feels that he has to do it, with a large family, and he knows there is somebody else in that department that will take his snoes, that anyone resigns, as a rule.

Senator HEFLIN. It is, to a large extent, the certainty of continuous employment. He knows as long as he does his work properly he will continue to have that employment, whereas if he would go with the company that gets Muscle Shoals he would know that in a few years his job would be over.

Mr. BUTLER. There is a great deal in that. A man gets in the habit of living economically and doing without things until he ceases to feel the want of them. Habit is one of the most tremendous factors in the world, and loyalty is another. But when the Government does lose them they get larger salaries and they keep climbing up, and often become the highest priced men in the world.

The CHAIRMAN. Let us bring it down to yourself. You are not a chemist and you are not an engineer.

Mr. BUTLER. If you had tried to make farming pay as long as I have, you would be something of a chemist and engineer both. I have tried to become a chemist to solve the problem of plant food.

The CHAIRMAN. If my bill becomes a law and you were offered one of these places at $7,500 a year, don't you feel you would be perfectly competent to handle it?

Mr. BUTLER. I say to you frankly, Senator, that the only thing that would make me take it, if I did——

The CHAIRMAN. I am not saying whether you would take it, but would you not recognize the fact, and would we not all recognize the fact, that as far as competency is concerned, notwithstanding you are neither a chemist nor an engineer, you would be able to fill the bill, because you know, in a practical way,

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more than a chemist does and more than an engineer does, the great problem that is to be solved.

Mr. BUTLER. Well, I feel this way, Senator, that I could do my duty there and select the special men for each place.

The CHAIRMAN. Exactly.

Mr. BUTLER. But you want a higher leeway for employing such specialists than your bill gives.

The CHAIRMAN. That might be.

Mr. BUTLER. That is just the point. We must get the best specialists in the world to handle this Muscle Shoals project to make a success of it, and we will have to pay them as large or larger salaries than anyone else in the world will pay for them. It would be false economy and folly to do otherwise.

The CHAIRMAN. Senator, we were speaking of the bill that provides for salaries of $7,500 for the three men that would be charged with this, and I was calling attention to yourself.

Mr. BUTLER. Yes.

The CHAIRMAN. Would you not accept that position for $7,500 just as quick as though it was made $25,000? You might not want it at all under any consideration.

Mr. BUTLER. If I were a rich man, Senator, I would gladly accept such a position, regardless of the salary, on account of my great interest in the most important work to be done there—the chance to render such a great public service. No man could desire to leave a greater monument than to do what can be done with Muscle Shoals for the prosperity of agriculture and the welfare of the whole country.

The CHAIRMAN. I would not expect to get as good work out of a man who took it purely for the money that was in it as a man who would take it because he was interested in a great problem such as this that we are trying to solve.

Mr. BUTLER. That is true; if the man was independent of his salary.

The CHAIRMAN. There is not any man, unless he happened to be very unfortunate or in some out-of-the-way circumstances, but what, in a position of this kind, if left where he is not tied up by any diplomatic proposition and is not compelled to shine in society and show off at dinners, balls, and so on—there is not a man but what with a salary of $7,500 can keep the wolf from the door and get along pretty well and educate his children and save a little money.

Mr. BUTLER. Of course, any man can do that if he has to do it. Lots of times that is so. Then look at this phase of it: But the same man, no matter how conscientious and patriotic he may be, will produce better results—we are so built—if he has an attractive profit coming as a result of his efforts than if he is being paid a modest salary. This is why the men in charge of the development of this great project should have an opportunity to reap a profit in proportion to the success they produce in making cheap nitrates. The greatest results will be produced if there is behind it the spur and incentive of profits commensurate with the success. This is the way to get the best out of a man.

The CHAIRMAN. Oh, yes; I think the man ought to have a profit. I think $7,500 will give a man a profit who will live right, and you will get a man who will make a success. On the other hand, if you give him so much you are apt to drive him crazy, make a society fiend of him instead of an actual worker in the line where you want him to do something.

Mr. BUTLER. The chance to have just reward measured by the success you produce is a wonderful stimulus to initiative and creative effort. There is really no limit to human capacity. The thing that is a surprise and a thrill to all of us is when we are put up against it, that we develop qualities that we did not know we had. The man who gets along through life doing just what we would call his duty each day never does fully develop; it is only when you have that incentive——

The CHAIRMAN. I agree with you, Senator, entirely. That is illustrated in every great effort. It was illustrated in the war, for instance. It is the same with a country as it is with a man. Incentive is the mother of invention. But you can not make a man better or have him invent more or do better or accomplish more by giving him a whole lot of money so he can live extravagantly and squander it.

Mr. BUTLER. Of course, you can not make a silk purse out of a sow's ear; and nothing is to be gained by paying a man a salary bigger than he is worth. That is a waste of money and a detriment to man. When you have a big under-

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taking which requires ability, skill, foresight, and initiative, then you will get the best out of a man if there is the stimulus of reward commensurate with the size of the success. That has been the experience of the world, and in a thing like this, where you have a new art, just in its infancy, with unlimited possibilities——

The CHAIRMAN. Somebody made improvements in the Haber process during this construction down there during the war. Wasn't it made entirely by employees of the Government?

Mr. BUTLER. Yes; but under the incentive of war, and I venture to say, with the greatest respect toward our experts who have made these improvements under that incentive, that if this proposition to continue nitrate development is dropped there will not be another step of progress made until the next war, when we will be caught again in a condition of unpreparedness.

The CHAIRMAN. I do not believe there will be; but on the other hand, suppose we go ahead and develop it and put these same men in charge—these Government employees—who are not getting salaries as much as a Senator gets, can we not expect as much development from them as you would get from anybody?

Mr. BUTLER. I would expect more from them if they had the stimulus of profit to take the place of the stimulus of war. The mainsprings of human action are fixed by nature, and we must touch them if we are going to call forth the limit of human capacity.

The CHAIRMAN. Do you think we could construct this dam cheaper if we would discharge Colonel Barden from the job and then employ him at double the salary?

Mr. BUTLER. The finishing of that dam is hardly a fair illustration. That work has already been planned and the finishing of it a matter of routine. But when it comes to working out the great engineering problem of developing the whole water supply of that river to its fullest we will do it more effectively than the Government can do it, even if the great engineer whom we have employed was back on the public pay roll and was in charge. Our whole organization will have a great incentive which will be absent from a Government undertaking. This will be true to even a greater extent in the development of the art of the fixation of atmospheric nitrogen. The chance for large profits will be the greatest possible incentive for the strictest economy in operation and fullest initiative to reduce the cost in making nitrates. But to come back to Dam No. 2, I feel sure that we can finish it cheaper than the Government can.

The CHAIRMAN. You may be able to do it.

Mr. BUTLER. I am sure we can. But that is a question we are not going to argue. We have put the alternative proposition in our offer, for the Government to finish it, or for us to; either will suit us. What we do want to do is to begin to operate that plant and carry out the main purpose in view as declared in the national defense act. Who builds Dam No. 2 is a bagatelle. It is an incident. We have offered to do it at the least figure we can do it, and we think we will save you money. It is immaterial to us whether we do it or the Government does it; but if you are going to give us the lease we want you to do it at the earliest date possible, so that we can go to work redesigning these nitrate plants, and be ready to operate them by the time the dam is finished. We want that done by our own experts who will operate these nitrate plants and conduct our research plant. If you delay action until after the low-water period this summer, you will lose a whole year in starting up this great project. In the mean time this large investment will be lying idle, the valuable property will be deteriorating, and that great water power will be running to waste, while our starved soils will be crying still louder for that most vital of plant foods. The cry for bread will be answered with a stone.

(At 12.30 o'clock p. m. the hearing was adjourned to 10.30 o'clock a. m., Monday, April 24, 1922.)

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MUSCLE SHOALS.

MONDAY, APRIL 24, 1922.

UNITED STATES SENATE,
COMMITTEE ON AGRICULTURE AND FORESTRY,
Washington, D. C.

The Committee met, pursuant to adjournment, at 10.30 o'clock a. m., in room 224, Senate Office Building, Senator George W. Norris (chairman) presiding.

Present: Senators Norris, McNary, Gooding, Norbeck, Harrison, and Heflin.

The CHAIRMAN. The committee will come to order.

STATEMENT OF HON. MARION BUTLER—Resumed.

Mr. BUTLER. We closed on Saturday with paragraph 20. Paragraph 20 provides for the engineers making joint reports to the lessee, and the Secretary of War.

Paragraph 21 provides for use of the stores and supplies on hand.

Paragraph 22 is complementary to paragraph 6.

We will now look again at that paragraph, so as to consider them together.

All responsible people, who are informed—who know what they are talking about—agree that nitrates can not be produced by the fixation of atmospheric nitrogen to-day at a cost low enough to enable farmers to use them for fertilizers. The cost is too high, compared to the selling price of the staple farm products. The process for taking the nitrogen from the air must be improved and cheapened. But everybody believes that this can be done and that it will soon be done. Now shall we proceed to develop this art and improve the process, or shall we sit down and wait for other countries to do it? Will we never learn anything except when forced by bitter experience? It is an old and true saying that it is a fool who will learn only from that costly school.

Well, we have had one sharp experience; are we so foolish that we must wait for another? We were caught in the last war where we could not get from this country or from any other country a sufficient supply of nitrogen for explosives alone. We were forced, without sufficient knowledge or experience, to try to get nitrogen from the air, regardless of cost. When the war was over, in spite of this costly and dangerous experience, we stopped; and we have done this foolish thing in the face of the fact that we have not a sufficient supply of nitrogen for the needs of peace times, to say nothing of preparedness for the next war.

The concensus of opinion of all authorities, the world over, is that there is no available known source of supply that is adequate except from the air. The scarcity of nitrogen in this country is more acute than in any other civilized country. We are not taking one pound from the air. Our total supply last year, including the imports from Chile and all the by-products from coke ovens and other minor sources of supply, was only 175,000 tons, while our soil needs many times that amount. Therefore we must either go ahead or develop the art to take it from the air so as to get a sufficient supply and at a reasonable price in times of peace for commercial purposes or sit and wait for somebody else to do it and then be at their mercy both as to price and supply. That would obviously be improvident to the point of being, if I may say it, both foolish and unpatriotic. So we have not only the experience of the war emergency, but we have also a continuing emergency before us to-day if we care anything for the prosperity of agriculture, which was starved for want of nitrogen even before the war and terribly starved during the war. We have a large investment already made at Muscle Shoals to do this very thing, but we are

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told that we can not to-day make nitrates there without a subsidy. That is true, but instead of asking Congress to vote a straight subsidy to make nitrates and to develop this art we have worked out a plan in this Engstrum proposal to have this great water power to finance the whole project. We will make the whole project finance itself by the sale of a part of the power produced. We have now two nitrate plants there. It is obvious we should run both of them, because all of the testimony is, that, if we run both of them at full capacity, we would not produce as much nitrogen as our country needs to-day for agriculture alone. But it will take only about half of the power to run both plants at full capacity, so we will have considerable excess power for sale. There is a market in the surrounding country for all of the excess power we will have for sale, and besides when you develop cheap electric power in any section of the world, at once the market—the demand grows and grows rapidly. So these questions of a market for this power—and think of the great good that it will do in that fine section of the country which has been backward in development by the sale of this excess power for local use and development.

Mr. Chairman, if we had this art of taking nitrogen from the air perfected now so that we could to-day make nitrates cheap enough for them to be used liberally on the soil, then I should say that we ought to devote all of that power from the beginning to running more nitrate plants. But in the present state of the art common sense says that we should proceed to develop the art and learn how to cheapen the process, and that the way to do that is to run the two plants that we have there and also a research plant, so as to be producing and learning at the same time. Then as soon as we can sufficiently cheapen the process we should build Dam No. 3 and another nitrate plant by it by the improved process; and then proceed to develop that whole river with more dams and storage reservoirs and more new nitrate plants. By the time we can get that whole million horsepower developed and devoted, all of it, to the manufacture of cheap nitrates, agriculture will be calling for every pound of it and more. the present rate of increased demand for nitrogen for fertilizers alone is 7½ per cent a year. That means that in nine and one-half years the supply needed will be doubled, even if the rate of demand does increase. But when we have cheapened the cost of nitrogen, then its use will at once be greatly increased. Farmers will buy twice as much when they can make a profit by using it.

Now, in order that this great investment at Muscle Shoals may be put to work producing the much-needed nitrates and selling them at from $5 to $10 less per ton we have worked out a plan in paragraph 6 for financing such production and operation, without calling upon Congress for direct subsidy. We have provided for creating a fund to finance the making of nitrates at a loss until we learn to make them at a profit. We create the large part of that fund by the sale of excess power, and while we are doing it we will be serving that country around by selling the people light and power that they need. It would be wrong, unless a great public and overshadowing national necessity called for it, to rob any section of the use of a part of the hydroelectric power developed there. Nothing but a national necessity would justify it, but if there is any one thing that would justify the use of all the hydroelectric power at any one place for one single purpose, it is to make cheap nitrates.

But, fortunately, we can serve all that surrounding country with light and power by the sale of excess current and make a profit on it large enough to run both these plants at full capacity without any subsidy from the Government. We can do that by saving what is to-day going to waste. That enormous water power is running to waste every minute. Your great investment, $106,000,000 here, is not only standing idle, producing nothing and losing interest, but it deteriorating every hour. Those plants would be better if run than standing ill. The $17,000,000 you have spent on Dam No. 2 will soon be a loss if that n is not finished. Besides, that dam as it stand there to-day is a block what navigation the people along that river had before. If we are not g to finish that dam, then we ought to put dynamite under it and blow it ust as quick as possible, and clear the river of this costly obstruction to ation.

w, we create that fund for the financing of the making of nitrates (during ime they must be made at a loss) by turning into it 66⅔ per cent of the ds from the sale of all the excess power; 75 per cent of the proceeds from the sale of by-product e proceeds from the sale of es and fertilizer compound them at a profit; and the

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typewritten amendment at the bottom of paragraph 6 provides that when that is not sufficient to run these plants at full time the lessee will contribute one-fifth of all his part of the proceeds from the sale of excess power also to that fund. Let us see how that will work out. We can not, of course, give you exact figures as to the sum that will be derived from each of these sources, but our proposed contract does state with exactness just what is to be done, and we do know that the fund will be large enough to do what is proposed. We can have a reasonable estimate on the intelligent and clear-cut testimony of Colonel Barden as to what it would cost to produce say 180,000 kilowatts and make it all primary power during the whole year by supplementing the water-power through the three months of low water period with steam power.

He estimated that it would cost $600,000 to run the two steam plants during the part of the year necessary to add to the primary power made by water to make 180,000 kilowatts of primary power. That is for coal and the operation of the steam plant. It would cost, for the whole year, only about $300,000 to run the hydroelectric plant. There we have a cost of $900,000, not counting labor that would be used in the nitrate plants. Now, let us see what we could do to meet that cost; to run those plants to the full limit both day and night. Admitting it will take 80,000 kilowatts (and probably it will take only 75,000 kilowatts) to run the two nitrate plants, we would then have at least 100,000 kilowatts of power to sell. Now, if we sold that much at, say, 1½ mills per kilowatt, then two-thirds of the proceeds would make $876,000 for this fund from the sale of power alone.

Remember that this is at the minimum price and for the minimum period of 12 hours per day, but we will always sell some power for more than 12 hours a day and for a higher price than 1½ mills. But we would have at the minimum $876,000 from the sale of that power to go into this fund. Then, taking the maximum cost of $900,000 to run the steam plant and the hydroelectric plant, we will be short only $24,000. Right here we come in with this typewritten amendment to paragraph 6, where the lessee agrees to contribute one-fifth of his part of the proceeds from the sale of power; one-fifth of one-third is $87,600. Add that to the $876,000 and we have $963,000; so we have a clean margin of $63,000 right from the start. Now, with the steam power and the hydroelectric power all paid for out of this fund, what can we make nitrates for?

Senator GOODING. How much of a margin? Let me have that again.

Mr. BUTLER. Eight hundred and seventy-six thousand dollars from the sale of power; 20 per cent contributed from the lessee, $87,600; making a total of $963,000, which pays the $900,000 expenses for the power plants and leaves a margin in the fund of $63,000 not needed. Then the cost of the nitrates will be determined largely by the cost of labor in the nitrate plants.

Senator GOODING. Is there any question about a market for the power?

Mr. BUTLER. None whatever. You heard the Alabama Power Co. appeal to you to let them have this excess power. They told you they needed at least 100,000 kilowatts more power now. They said they would have to go somewhere else to develop that much power if they could not get this, because they had a market for it now. There is no place where they can develop that power as cheap as we can sell it to them. The estimate which I have given you was based on a minimum price of 1½ mills, and we will sell it, probably, higher than that. The Alabama Power Co. is selling all of its power much higher than that. Their lowest is 5 mills, and from that up. We figured to sell it by wholesale. We do not intend to enter into the retail business. We intended to offer this power to the several power companies near enough and let them retail it through their distributing systems.

Senator GOODING. Is it necessary to build transmission lines?

Mr. BUTLER. We have provided that this transmission line shall go with this lease.

Senator GOODING. That will deliver it direct to the Alabama Power Co.

Mr. BUTLER. If they give us the best price for it, we will sell it to them, but if they do not we will take up that transmission line and connect it up with somebody else. Anybody who wanted it worse than the Alabama Power Co. would unquestionably move that transmission line for us or will build a transmission line to Muscle Shoals to get this cheap power. It will be the cheapest power in that country.

The CHAIRMAN. You say, Senator, this 20 per cent in this tyewritten amendment that you have added there would bring in $87,000?

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Mr. BUTLER. Yes; $87,600, to be exact, on the estimate submitted.
The CHAIRMAN. That is 20 per cent of your income?
Mr. BUTLER. Yes; as estimated.
The CHAIRMAN. Then the gross amount of your income——
Mr. BUTLER (interposing). Will be one-third of the proceeds from the sale of power. Under the estimate it would be——
The CHAIRMAN (interposing). About $435,000?
Mr. BUTLER. $438,000, even.
The CHAIRMAN. Income?
Mr. BUTLER. Gross income.
The CHAIRMAN. You would get that from——
Mr. BUTLER (interposing). From our part of the sale of excess power. We would sell that power for $1,300,000, according to this estimate.
The CHAIRMAN. You figure that you would get something over a million dollars?
Mr. BUTLER. $1,314,000, to be exact, is the least possible estimate from the sale of that much power.
The CHAIRMAN. What power you would not need to run these plants?
Mr. BUTLER. About what is needed to run both plants at their full capacity, day and night. We could sell that much power and have that much cash. That is the minimum.
The CHAIRMAN. Under your proposition you get $438,000 of that?
Mr. BUTLER. Exactly.
The CHAIRMAN. The Government gets the balance?
Mr. BUTLER. Yes; $876,000.
The CHAIRMAN. The Government?
Mr. BUTLER. Yes. And under this amendment we would contribute $87,000 out of our part to this fund.
The CHAIRMAN. If you did not get enough from these other funds provided for under section 6, you would be bound under your contract to contribute 20 per cent——
Mr. BUTLER (interposing). All the time.
The CHAIRMAN (continuing). Of your part until the other means of income might be sufficient?
Mr. BUTLER. Just as long as it is necessary to produce we have maximum results.

We have still a further provision in paragraph 15. Until that fund is so created from the sale of power we have provided to advance all the money necessary for the operation of the plant. So there is not a chance under this proposal for this plant to ever stand idle for a minute for want of sufficient funds.

Now let us come back to the cost of making the nitrates.

We have taken off all the cost of the steam plants and the hydroelectric plant by the sale of excess power; so there is not anything left but the labor used in the nitrate plants and their upkeep. With all this cost taken off, we will be able to make these nitrates for $35 a ton or less, in my opinion. Therefore we can undersell Chilean nitrates the very first day. This subsidy from the sale of power will do it, beyond question. Then it is just a question for the Secretary of Agriculture to say whether we will sell these nitrates for $35 or $40 a ton. If we sell at $40 we will be making $5 a ton, say, as profit; we will get, of that, $1.25 a ton for our profit and will turn $3.75 a ton into this fund.

But when we improve the Haber process so that we can make nitrates for the selling price, and the proceeds of the sale of excess power is not needed to subsidize the making of the same, then all of this fund will go into the Treasury of the United States as cash rental on the lease.

In paragraph 22, subsection (a), we have also provided that when Dam No. 3 is built and nitrate plant No. 3 is put up by it, we will then ask for only 25 per cent from the sale of excess power, and we will contribute to this fund 75 per cent of the proceeds. We can do this because our overhead charges will not be increased in proportion to the increase of power produced, and therefore we can afford to handle the larger proposition for smaller percentage of the sale of excess power. The typewritten amendment at the end of subsection (a) provides for the 20 per cent to be contributed by lessee under conditions named in section 6. The remainder of the revenue to lessee will come only when he has made a complete success. It will come from 25 per cent of the profits on nitrates and fertilizers, if we ever sell them at a profit.

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But in another section it is provided that we shall never receive any profits on nitrates, even if they are sold at a profit, until the amount paid into the Treasury of the United States from the sale of excess power shall be the full amount collected, without any of it being contributed to finance the manufacture of nitrates. When that time comes, then if the nitrates are sold above cost we shall share 25 per cent of the profit. We expect to reach that time, and we should, of course, share in the profits for having accomplished such a result. Lessee's other source of income is from 25 per cent of the sale of by-products.

Section 23 provides for furnishing free to the Government all the power necessary to operate the lifts or locks.

Paragraph 24 is the emergency provision. We surrender this property to the United States Government under any emergency, or agree to devote it all to making explosives for the Government, if the Government desires us to do so.

Paragraph 25 is as follows:

"The lessee agrees to protect the Government for the full and faithful performance of the contract by giving a good and sufficient surety bond, to be approved by the Government."

We put no limitation on that bond.

Par. 26. Inspection: It provides that the Government shall have access to our books and everything we do. Besides, we will have two directors from the Government in our company, sitting on the board of directors all the time.

Par. 27. Repairs: We felt that we had to provide, if a leak was found in dam No. 2 after we begin to operate, the Government should itself repair that without taxing the fund for making nitrates. This is a possible danger in that limestone country.

The CHAIRMAN. What investigation have you made, if any, along that line? I was curious when I read this, why you put it in your proposal. Are you suspicious that there is something wrong there with the foundation of this dam?

Mr. BUTLER. I think the Government engineers have some doubt about it. It is not an anticipated, but a possible, danger.

Senator HEFLIN. That is the first time I ever heard anything along that line.

Mr. BUTLER. Well, Senator, I don't think that there is any real cause for worry. But we know in a limestone country that the question of building a power dam must take this possible danger into consideration. After you get the pressure on to its full head you may have water come from below, through some subterranean crevice. That is a peculiarity of a limestone country; and if you start with a little crevice, it will soon grow big by the pressure from the water, and it is necessary to correct it at once.

Senator GOODING. Is this limestone broken to some extent?

Mr. BUTLER. Yes; subterranean holes through it.

Senator GOODING. We have just such a condition in the lava country.

Mr. BUTLER. It is probably more serious in a lava formation. Here at Muscle Shoals we have poured cement into every hole above the dam where we thought there might be the beginning of an outlet. If we have succeeded in forcing that cement into every crevice, then it is safe—"bull high and hog tight," as we say in the South. Our engineers think they have done that. They have used every precaution and they think it is all right, but everybody knows that you can never be sure until you put the pressure on it.

Senator HEFLIN. If they should discover one, they could stop that by pouring cement?

Mr. BUTLER. Yes.

Senator HARRISON. It really is not a very serious proposition?

Mr. BUTLER. No; if you take it in time, and it is not too big.

Senator GOODING. It has to be found.

Mr. BUTLER. The only trouble is in finding it.

Senator GOODING. We have been through all that in the West.

Mr. BUTLER. The water may pass under the dam before you can detect it. Our engineers have gone down below and have tried to find if there is any sign anywhere of the water rising, but, of course, it would be worse when the pressure goes on if there is any such leak.

Senator HEFLIN. How deep is this foundation there?

Mr. BUTLER. They have bored down, if I remember the testimony—how many feet, General Haan?

Gen. W. G. HAAN. They told me when I was down there that they had driven some tunnels into the banks where the dam is to be to a depth of something like 700 feet, and that apparently since they got into the virgin rock away from

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the surface these crevices rapidly disappeared, and they really, so far as I can ascretain, apprehend very little danger from any such source.

The CHAIRMAN. You are speaking of that work off on the side. That was not under the foundation of the dam. We saw that when we were there.

Senator GOODING. There is that element of risk. I have in mind exactly such a condition as that out in my country in building a reservoir, building an earth and rock dam. The same thing happened, but they succeeded in finding it and checking it by pouring cement.

Mr. BUTLER. Our engineers think that they have plugged every possible hole. They have used all possible precautions.

Senator GOODING. When you say "our engineers" do you mean the Government engineers?

Mr. BUTLER. The Government engineers.

Senator GOODING. I think a provision of that kind is proper.

Mr. BUTLER. Anybody who knows about the formations in a lava country and a limestone country knows that that possibility is there.

Senator GOODING. There is the possibility there that should be provided for.

Mr. BUTLER. It has been provided for as far as foresight can do it, but there is still the possibility, and this is why we put in this paragraph:

"PAR. 28. Proposal divisible."

As already explained, if the Government prefers to go ahead with Dam No. 2, then we will accept the lease subject to that condition. But we want you to make this lease with us at once, even if the Government finishes Dam No. 2, so that we can go to work redesigning the nitrate plants and have them ready to run as soon as the dam is completed; obviously this should be done.

Now, Senators, here is a proposal which is plain; it is workable, it is just, and it will be a success, one that through 50 years will be conducive to success by forcing the lessee, under all conditions, to put forward his fullest ability and capacity to serve the public and the Government's interests or his own interests will suffer. It is designed to carry forward the declared purpose of the national defense act. As one American citizen, I feel that to the extent of my capacity I ought to urge Congress to go forward with that great purpose without further delay. The delay since the war has been inexcusable, with the needs for more nitrogen growing each day.

Suppose war should break out again to-morrow. We could not get nitrogen for explosives alone except from the air, and we are not prepared. We can not get enough even now in time of peace for the soil alone. Should war come, we will need a double amount, because modern warfare calls for all resources. In the last war our great cry was to make biscuits, because they were just as important as bullets to win the war; yet we called upon our farmers to make "bricks without straws." We tried to do it, and we exhausted our soil until to-day we can not make it produce half what it should produce from the labor and effort that we put on it. This is a most serious situation. It affects every consumer as well as every producer. It also jeopardizes the national safety.

If we care nothing for the success of agriculture, then we should remember the dangerous position we were caught in without nitrogen when we were rushed into the World War. We then rushed blindly trying to get nitrogen from the air. Will we refuse to think except when a gun is pointed into our faces? The way to win the next war is to be prepared with plenty for both agriculture and for war when it comes. With that $106,000,000 investment standing there idle and with the greatest water power in the United States still unharnessed and running to waste, what shall we do? Will we take the back track and scrap it and throw it away? Will we let that investment be sold at scrap prices, to be taken by somebody to be used for private profit? That is most improvident. It is inconceivable, with the needs before us, that we would do such a thing. Yes, there it is; and since the war we have not raised a hand to finish that work. The investment is there, it is deteriorating every hour, the water power going to waste, and our starved soils crying for nitrogen.

Senator MCNARY. Do you propose to use this in the public service, for the public good, or for private gain?

Mr. BUTLER. We propose to carry out the purposes of the national defense act and to do it on a business basis. Obviously, the way to get the best results from such an enterprise is to make the profits of the lessee dependent upon the success of that enterprise, and that is the way we have drawn up this proposal. We have purposely tied ourselves up so that we can not prosper unless we make a success of this whole enterprise. But if we develop this art and produce

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great results we will prosper accordingly. I believe with that kind of an incentive behind us we will produce greater results than the Government can produce without such incentive. Human nature is so constructed that we can get out of our own selves greater results if we have such a spur and incentive.

There is, in fact, no known limit to human capacity; we never know what we can do until we are put to the test; it is indeed a misfortune to any man to be forced to go through life without ever being put in position where he must meet obstacles or have the greatest incentive to arouse and call forth all of his unknown latent powers. Those who have been put to such tests and who have met them, have had an electric thrill when they found that they could do what they had never thought possible. That is the key to individual development and to human progress. If we will put such a spirit behind the problems of seizing from the air an ample supply of cheap nitrogen the thing will be done in the quickest and most efficient manner.

Senators, it is inconceivable that you will do nothing; either have the Government do it or let us do it. If this proposal is not sound in any respect, if it is not fair in any respect, if there is any weak spot in it, then give us a chance to change it.

A sufficient supply of cheap nitrogen is of such vital importance to revive our staggering agriculture that I, for one, am willing to take this contract with the profits cut to the bone to start with, provided there is left in it a chance to be properly rewarded if we produce the result desired. Now, I have every confidence that it can be done.

Senator GOODING. Put up your money and take the chance that it can be done?

Mr. BUTLER. We will put up our own money until we create a fund, under paragraph 6, to finance the production of nitrates. But the construction should be paid for by the Government, because the Government should hold the title to this property.

Senator HEFLIN. And put up its own money?

Mr. BUTLER. Certainly; because it is Government property. We are not buying anything from the Government. We are offering to lease it to carry out the purposes of the national defense act, and at the end of 50 years we agree to return this property to you in perfect working condition, when it will be many times more valuable than when we take charge of it. This property will be of immense value at the end of 50 years, and then the Government gets it back and the benefit of all the development. We do not even put in this proposition that we shall have a preference at the end of 50 years, because if we have not satisfied the American people and the Government at the end of 50 years that we have done our duty, and done it satisfactorily, we don't want any preference, and we would not deserve it if we did want it.

What agriculture wants done with Muscle Shoals is exactly what is provided to be done under this lease. Every resolution passed by every farm organization and every women's organization directed to reducing the high cost of living and promoting the public welfare have all called for cheaper nitrates, cheaper production, cheaper food and clothing. The Engstrum proposal is the only one before you that proposes to devote this whole proposition to doing that very thing.

Senator MCNARY. Do you think that this proposal would affect the cost of living by reducing it?

Mr. BUTLER. Unquestionably; whenever you reduce the cost of production you reduce the cost of living. Cheaper nitrogen means cheaper food and clothing.

Senator MCNARY. Oh, well, but that plant will not produce enough fertilizer, as everyone knows, to put in a wheelbarrow, as far as that capacity is concerned, in comparison with that which is used, but how is the development of that plant, producing that small amount of fertilizer, which is perhaps one-tenth or one-twentieth of the consumption of the whole country, going to affect the cost of living and cost of agricultural products?

Mr. BUTLER. We can produce at Muscle Shoals with the two nitrate plants there 230,000 tons of nitrates, which will make 2,500,000 tons of fertilizers. This is half of the total amount of fertilizers used in this country last year, and that quantity will certainly stabilize the price.

Senator MCNARY. I have heard that before, but I have no confidence in it at all. I am expressing a frank opinion.

Senator GOODING. I don't think you heard Mr. Butler's proposition as to how much power is to be used down there.

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Senator McNARY. I know how much power there is there, unless you increase the minimum capacity by the process of storage.

Mr. BUTLER. We look forward to that if we are given this contract.

Senator McNARY. Do you propose to make a complete fertilizer, or simply sulphate of ammonium?

Mr. BUTLER. We propose to offer both to the public under regulations to be approved by the Secretary of Agriculture, because our Agricultural Department is trying to teach the farmers to mix their own fertilizers. It is cheaper for them to do it, and they can then use the fertilizers more intelligently.

Senator McNARY. You mean mix it without the filler and use it in concentrated form?

Mr. BUTLER. We should offer for sale, with the approval of the Secretary of Agriculture, the nitrates alone, or the complete fertilizer. But it will be cheaper for the farmer to buy his ingredients and mix them himself.

Senator McNARY. Eighty-five per cent, of course, is filler. We all know that. There are three elements that go to make up fertilizer. How many farmers, without a knowledge of chemistry, and very careful application of formulæ can take it in its concentrated form and use it without great injury to his crops? There is not one in a thousand.

Senator HEFLIN. They would have instruction from the Agricultural Department.

Mr. BUTLER. Yes, and county agents; but my negro tenants know how to do that. They know that 100 pounds of 16 per cent potash contains only 16 pounds of potash. The same with 16 per cent nitrate of soda and 16 per cent phosphoric acid. So they know that if they take 250 pounds of potash and 250 pounds of nitrate of soda and 1,000 pounds of phosphoric acid and then add 500 pounds of sand that they have a ton of what is called 8–2–2 down South or 2–8–2 up North. They know that a unit in fertilizer is 20 pounds and that two units are 40 pounds, and that it takes 250 pounds of bulk of 16 per cent potash to contain 40 pounds. The same with the 16 per cent nitrogen. And the 8 means that there is four times as much phosphoric acid.

Senator McNARY. We use a different one up in our country. We have higher nitrogen.

Mr. BUTLER. Then you have 9–3–3 or 10–4–4. The unit of any one of these ingredients is 20 pounds; but each one of the three plant foods—nitrogen, potash, and phosphoric acid—are each contained in a holder which is from five to eight times the weight of the plant food, making 1,500 pounds, and then 500 pounds of sand is added to make the 2,000. The sand is the filler and is different from the holder.

Senator McNARY. I understand that thoroughly. It is clearly demonstrated in the House hearings; but that does not cover my point at all. I have simply tried to develop this thought, and you will find it in the testimony before the House committee, by all the scientists, that there is not one farmer in a thousand can use a concentrated fertilizer without the filler. They have not the machinery for it. I have seen it applied on fruit trees in the West thousands of times without success; but that does not particularly develop my point. I want to know how much fertilizer you are going to make at this plant in completed form under your horsepower?

Mr. BUTLER. We will produce, with these two plants, around 240,000 tons of sulphate of ammonia annually.

Senator McNARY. Reduce that, now, to nitrates.

Mr. BUTLER. That will make 2,500,000 tons of fertilizer, but we will offer the nitrates to the farmer and urge him to do his own mixing. Our farm agents are instructed to tell a farmer, if he buys concentrated goods, how much sand to mix with it. We have farm administrations to-day of such capacity that they visit the farm and ask the farmer: "What are you going to put in this soil, cotton or corn or tobacco? Then you need this mixture of fertilizer for that crop on that field." They analyze the soil for him and they tell him what mixture to use for that field and that crop.

Senator HEFLIN. I have known a great number of farmers who do mix it.

Mr. BUTLER. The number is rapidly increasing each year. Where a farmer once learns to mix his fertilizer, he never again buys any of the ready-mixed stuff.

Senator HEFLIN. Have you had any bad effects from the mixing?

Mr. BUTLER. Not a single case on my plantation or elsewhere within my personal knowledge.

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Senator McNARY. I don't want to insist on an answer to the question, but you are getting off again.

Mr. BUTLER. We make 240,000 tons. That will produce about 2,500,000 tons of fertilizer at 8–2–2. That is about half what we used last year. Now, there you are.

Senator McNARY. That is one element of the fertilizer. Is that ammonium sulphate or ammonium nitrate?

Mr. BUTLER. Ammonium nitrate is the explosive. There is some fertilizer value, but that is more expensive, mind you, than the ammonium sulphate, and that is for explosives. That is what we made during the war. But ammonium sulphate is the soluble form of nitrogen that is desirable for fertilizer.

Senator McNARY. I understand. That is 240,000 tons, or one-half of the ammonium sulphate. That is one ingredient?

Mr. BUTLER. Yes, sir.

Senator McNARY. And it is two parts and the potash is two parts, and the phosphoric acid eight?

Mr. BUTLER. Yes.

Senator McNARY. So you have 2 out of 12, which comes a long way from being fertilizer.

Mr. BUTLER. It is one-sixth of the total weight, but it is the scarcest and most expensive element of all.

Senator McNARY. I beg to differ on that. We have a source of supply of nitrates, but we have only one place, or two, where there is any potash developed in this country.

Mr. BUTLER. We are not producing any nitrogen in this country except the by-products from coke ovens and other minor sources.

Senator McNARY. And what we import from Chile.

Mr. BUTLER. Last year we used in this country only 175,000 tons, and half of that came from the coke ovens and the other half from Chile; that is all we used, on account of its scarcity and high price, when we needed to have used four times that. Germany got, last year, from our coke ovens about 100,000 tons and made 400,000 tons from the air to get her 500,000.

Senator McNARY. I believe in it, Senator. We are both alike on that. But it is not fair to say that we will produce that much fertilizer. It is an important ingredient of fertilizer, I know, but it is only one portion of the fertilizer, and it is misleading to make the statement.

Mr. BUTLER. Nitrogen is the only ingredient for which there is no adequate source in this country, or in the world.

Senator McNARY. That is a fair statement, but the other is not.

Mr. BUTLER. And there is not any known source for an adequate supply except from the air.

Senator McNARY. I think we all have the same opinion.

Mr. BUTLER. The world is better supplied with potash. The Province of Alsace and Lorraine has very valuable potash deposits. There are enormous deposits in Germany, and we are developing some in this country. Besides there is some potash in all soils.

Senator McNARY. There is a little in southern California and a little in Idaho, and there is some in Colorado, but we do not know that there is enough. We have tried an experiment. The Government had a plant out there, but it did not prove a success.

Mr. BUTLER. We are getting some very good potash from this country. But let us suppose we had to import every bit of potash into this country—is that any reason why we shall refuse to develop the fixation of nitrogen from the air? It is the only safe source of supply.

Senator McNARY. I tell you again, Senator, I quite agree with you, but it is the method of getting it that I am interested in.

Mr. BUTLER. We must get it from the air and we must find a cheaper method or process for doing it. That is what we must do at Muscle Shoals. We must keep doing the thing until we learn how to do it cheaper. We should run both plants and also run a research plant. We should devote this whole project to the one great purpose of making cheaper nitrates and then more nitrates. So our proposition looks to developing this whole river within 10 or 15 years, and devoting the whole thing to making nitrates. And before that can be done we will have need for all the nitrogen which can possibly be produced by the use of all the 1,000,000 horsepower of that river.

Nitrogen is the one vital plant food which we must have and which we must get in this way, because there is no other way to get it.

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Senator GOODING. It is your proposition to turn this plant to its fullest capacity for that purpose?

Mr. BUTLER. Yes; and then we can not produce enough until we build more dams and more nitrate plants.

My idea is to sell these cheap nitrates, Senators, to the public and to the fertilizer companies just as cheap as to the farmer. I don't believe in attempting to destroy the value of all the fertilizer companies in this country; if they will mix fertilizer at a reasonable profit, then they ought to be allowed to do it. If we can make and sell these nitrates to everybody, including the fertilizer companies, at the same price and $10 a ton below present prices, then it would hurt nobody, but it would simply mean cheaper fertilizer, whether we or the fertilizer companies made the complete fertilizer. The fertilizer companies can make as much profit mixing cheap nitrates as they can mixing costly nitrates. Cheaper nitrates mean cheaper fertilizers, and cheaper fertilizers mean larger yields to the farmer at less cost, and cheaper food to the consumer. The one way to accomplish these things is to develop Muscle Shoals and devote the whole project to the production of cheap nitrates.

Senator HEFLIN. Senator, farm organizations all about in the South and West have passed resolutions in favor of developing the Muscle Shoals project and having fertilizer made there.

Mr. BUTLER. Yes; and they want the whole project devoted to that one purpose.

Senator HEFLIN. The Fertilizer Trust of the United States has sent a lot of literature to Members of the House and Senate protesting against——

Mr. BUTLER. I have read it all.

Senator HEFLIN. That would indicate that the farmer knows that he is going to get fertilizer cheaper if this thing is put through, and the Fertilizer Trust knows that its day of monopoly on this thing is gone if it is developed at Muscle Shoals.

Mr. BUTLER. The fertilizer companies are acting very foolishly. With cheaper nitrates they can sell fertilizers cheaper and make still the same profit; and if fertilizers are cheaper the farmers will buy much more of it. The only people who have a real reason to oppose the development of Muscle Shoals are the coke-oven people, who want a high price for their by-products, and the nitrate kings of Chile.

Senator HEFLIN. The question is whether we will do that which is best for the largest number of people or permit a few people to hold up the whole mass of people who use fertilizers.

Mr. BUTLER. That is the whole proposition in a nutshell.

Senator GOODING. Then it is your purpose to use the first power for fertilizer?

Mr. BUTLER. We have provided that we should use secondary power for running these plants as far as it can be done without limiting the output, because we can sell the primary power at a higher price, and it is necessary to raise in this way the money needed to finance the making and selling of nitrates at a figure below cost, until we can learn how to make them cheaper. But under the estimate which I gave you, based on Colonel Barden's estimate of cost to produce 180,000 kilowatts of primary power, we can use 80,000 kilowatts of that power to run these plants and have 100,000 kilowatts to sell. This will finance the plant and enable us to sell these nitrates at $35 a ton or less at the beginning—with cheaper nitrates our farmers will use at least 10,000,000 tons of fertilizers next year. The saving of $10 a ton will mean a saving to the farmers of $100,000,000 next year. In nine and one-half years we will be using over 20,000,000 tons; then there will be a saving of $200,000,000 a year. Before the end of this lease our farmers will be using 100,000,000 tons; that will mean a saving of $1,000,000,000 a year. These are enormous figures, but they are the inside of what can be done, because as soon as we develop a cheaper process for taking the nitrogen from the air we will be able to save much more than $10 on every ton of fertilizer. Indeed we will make this investment at Muscle Shoals pay for itself almost the first year in the amount saved on the fertilizer bill of the country. We will make it pay for itself many, many, and many times over during the life of this lease.

There can be no question about the wisdom of going ahead with this project and devoting the whole thing to the production of cheap nitrates. It would be a monstrous thing to abandon this project or to scrap it or to sell it to a private monopoly. It will be almost as bad to lease it to one who will use only one-tenth of this power for making nitrates, while using the other nine-tenths

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for private profit. That would be robbing the farmers of a sufficient supply of much needed nitrates and at the same time subsidizing one person to compete with all other American citizens in private manufacturing. Such use of public money will be indefensible from every standpoint. We must not make such a mistake, and we must not longer starve our soils by delay. Neither should we deny the people around Muscle Shoals a chance to buy some of this cheap current for light and power. Every man down there is or should be for the Engstrum proposal, except the men who expect within the next few months to reap a fortune in a real estate boom. Those men will unload and get their profits and then disappear. The people who buy this land will be left there with no chance to buy cheap light and power; the farmers will not get their fertilizers, and the people around will not get their light and power if we turn this project over to a private monopoly, because the power will be used for private manufacturing. They will see that great water-power development at their very doors and will not be able to buy one kilowatt of it. That thing should not happen there, as it has happened at Niagara Falls. The Engstrum proposal is the only one which will sell part of the power and light to these people and then take profit and use it to finance the production of cheap nitrates. We propose to utilize to the fullest this whole investment to serve a great public need. Then give us this lease and let us begin, or in heaven's name have the Government do it. This is by far the most important thing before Congress, and it calls for action; not next year, but now.

Senator GOODING. A public calamity unless it is met in some way or other.

Mr. BUTLER. This is the only proposal before you which provides for devoting that whole water power and that whole investment to the making of cheap nitrates. We will produce the maximum supply at the lowest cost. Therefore I appeal to you to give us this lease and do it now or proceed to have the Government at once perform this great public service, for which there is a nation-wide need.

Mr. Chairman, I want to thank you and your committee for your courteous attention.

The CHAIRMAN. You said Saturday, Senator, that Mr. Engstrum wanted to be heard a few minutes.

Mr. BUTLER. Yes; he is present.

ADDITIONAL STATEMENT OF MR. FREDERICK E. ENGSTRUM.

Mr. ENGSTRUM. Mr. Chairman, Senator Butler has expressed our views and explained our offer in every detail, and I simply desire to repeat that the spirit in which this offer is made is that I hope that suggestions can be made whereby we can amend this offer in any way possible to make a contract that will be capable of being lived up to and operate for the period which this lease calls for. If the committee has any questions to ask me regarding this offer or on any subject that I can answer, I will be glad and will endeavor to answer them, and if there are any suggestions whereby this offer can be amended I would greatly appreciate such suggestions, and if in the future the committee desires any further light on the offer or any figures to be worked out I will be glad to supply them.

I have engaged Gen. George W. Goethals to act as my engineer and as director of this company in case this contract is awarded me for the company.

The CHAIRMAN. Will General Goethals be interested in it in a financial way?

Mr. ENGSTRUM. Yes.

The CHAIRMAN. He will have charge of the construction work, will he?

Mr. ENGSTRUM. Yes, sir.

The CHAIRMAN. Will he be one of the officers of the corporation which you propose to organize?

Mr. ENGSTRUM. Yes, sir.

The CHAIRMAN. Senator Butler said that the proposition was to organize a corporation with $2,500,000 capital, or about that.

Mr. ENGSTRUM. Yes.

The CHAIRMAN. Do you expect that to be paid in, all of it, at once?

Mr. ENGSTRUM. We would want to go into that matter. Whatever Congress would want, or whatever the committee thinks necessary to put in, we will arrange to have put in, not on a public stock-selling proposition, but a syndicate of our own friends and our own interests.

Senator GOODING. There is no question about it, but that you can raise the necessary money?

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Mr. BUTLER. In paragraph 15 we provide to advance the money right from the jump.

The CHAIRMAN. Are there any other questions by members of the committee?

Mr. BUTLER. May I, at this point, leave with the committee a diagram which we have prepared and which I intended to use while discussing paragraph 6 and Colonel Barden's testimony, to show to the committee by a curve drawn on the diagram of just how the water power at Muscle Shoals must be supplemented by steam power.

If the members of the committee will notice, this curve illustrates it. Up to this point that is primary power that will be produced from the hydroelectric dam for the year around without any coal. Where this curve begins is where we must begin to supplement the water power with steam power, and it shows just how much steam power must be added each week to make up the falling supply of water as we approach the dry weather period. This diagram illustrates Colonel Barden's testimony. We will leave a copy for each member of the committee.

(At 11.50 o'clock a. m. the hearing was adjourned to 10.30 o'clock a. m. to-morrow, Tuesday, April 25, 1922.)

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MUSCLE SHOALS.

MONDAY, MAY 1, 1922.

UNITED STATES SENATE,
COMMITTEE ON AGRICULTURE AND FORESTRY,
Washington, D. C.

The committee met, pursuant to adjournment, at 10.30 o'clock a. m., in Room 224 Senate Office Building, Senator George W. Norris (chairman) presiding.

Present: Senators Norris, McNary, Capper, Keyes, Gooding, Norbeck, Harreld, Kendrick, Harrison, and Heflin.

The CHAIRMAN. The committee will come to order. Mr. Mayo, we are ready to hear you.

STATEMENT OF MR. WILLIAM B. MAYO, CHIEF ENGINEER OF THE FORD MOTOR CO., DETROIT, MICH.

Mr. MAYO. I don't know just how you wish to conduct this hearing. Do you expect me to make a statement?

The CHAIRMAN. We are going to let you handle it. We have given everybody a free rein, and now we are ready to take up Mr. Ford's proposition. I wish you would first give your name, occupation, and business for the record.

Mr. MAYO. W. B. Mayo, chief engineer, Ford Motor Co.

The CHAIRMAN. Where do you live, Mr. Mayo?

Mr. MAYO. Detroit, Mich.

The CHAIRMAN. Your description of your business, I think, sufficiently describes who you are. Proceed now in your own way in regard to the offer that Mr. Ford has made for the purchase or the leasing of Muscle Shoals.

Mr. MAYO. I brought over with me, I think, enough copies of Mr. Fords offer for each member of the committee, showing all of the clarifications as it stands to-day; we clarified the language of the offer somewhat while going through the hearings before the House Committee. I don't know that I have any statement to make in regard to it other than here it is and I am open for questions.

The CHAIRMAN. Well, if you want to take it that way, I will ask you, Mr. Mayo, to state to the committee in your own way what in your judgment the offer of Mr. Ford in plain English means. I think it would be well for you to take it up section by section and explain it to the committee.

Mr. MAYO. It means, in general, that Mr. Ford proposes to take over all the nitrate plant property of the United States located at Muscle Shoals, together with their steam power plants in fee, and to take a lease of the water power portion of the project, which includes two dams known as No. 2 and No. 3.

Taking the offer up paragraph by paragraph, the first thing which appears of any real importance which has been talked over at quite some length, with the House Committee and was in regards to the size of the company that Mr. Ford proposed to form; what amount of capital it might have, which amount you will see we have inserted. It is to be a company with paid-up capital stock of not less than $10,000,000.

Then in paragraph 2 it refers to dam No. 2, with its locks, power house and equipment, all to be built in accordance with the present plans that have been made by the United States engineers.

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The CHAIRMAN. Have you any information to give the committee as to who will compose this company—who will own the stock in it? Who besides Mr. Ford will be interested in it in a financial way?

Mr. MAYO. I don't think anybody at present but Mr. Ford and his immediate family.

The CHAIRMAN. Practically, Mr. Ford will put up all the capital, then?

Mr. MAYO. Yes, sir. Paragraph 3 further relates to Dam No. 2 and states the lease price that he pays, which is all fully explained. Paragraph No. 4 sets out the maintenance fee that is paid annually.

Senator MCNARY. Mr. Chairman, may I make this observation? The document before us contains a letter from Henry Ford dated July 8, 1921. That has numbered paragraphs in it, then there is a proposal, I imagine a supplemental proposal, in the back, and that has numbered paragraphs in it also. I was wondering if the witness was speaking of the first proposal or the modified one?

Mr. MAYO. The modified one. Everything, as it now stands, is in accordance with this last one, which is entitled "Copy."

The CHAIRMAN. I should think, Mr. Mayo, it would be very appropriate at the beginning of your testimony to have this amended proposition of Mr. Ford printed in the record at this point. You can do as you please about it, but the record ought to show, I should think, just what your proposition is. So far it does not appear.

Mr. MAYO. I thought it did.

The CHAIRMAN. We have no information, for instance, as to these modifications of your proposition now before us.

Mr. MAYO. I see. Well, then, I suggest that we put this modified proposal in the record.

(The proposal was further modified in the course of Mr. Mayo's statement, and, as further modified, will be found at the conclusion of his statement.)

Mr. MAYO. Paragraph No. 5 refers simply to the power we are to furnish to the Government for the locks, which is furnished free; that is, the locks in connection with Dam No. 2. Paragraph 6 refers to starting the work on Dam No. 3 as soon as the construction equipment is released from Dam No. 2 and sets out the amount of horsepower which is to be installed, and further sets out the fact that the Government shall purchase all flowage rights and rights of way which are to be acquired through an agent of the company. Paragraph No. 7 relates to the building of Dam No. 3, and its locks, power house, and equipment.

Senator GOODING. Are you reading from the copy now?

Mr. MAYO. Yes, sir.

It also sets out the amount of lease price for Dam No. 3.

Paragraph 8 refers to Dam No. 3 and the amount is set out for the maintenance of that dam.

Paragraph 9 refers to the amount of power furnished from Dam No. 3 for its locks, which is also furnished to the Government free.

Paragraph 10 refers to the sinking fund that is set up to wipe out the entire capital cost within the hundred years' lease period.

Paragraph No. 11 refers to all the nitrate plant property, including nitrate plant No. 2 and nitrate plant No. 1 and contiguous property. It also includes the Waco Quarry property, also the property of the Warrior River plant at Gorgas. You will notice some changes in this paragraph. We have so changed it that it only includes everything now owned by the Government.

The CHAIRMAN. In other words, your modification means, as I understand it, that the Government assigns to you whatever rights it may have there, and you step in the Government's shoes?

Mr. MAYO. Exactly.

The CHAIRMAN. As you had it at first, you required the Govermnent to give you a good title to the whole thing?

Mr. MAYO. Yes, sir.

The CHAIRMAN. Not only what the Government owns, but what the Alabama Power Co. owns?

Mr. MAYO. No, sir; only what the Government owns.

The CHAIRMAN. In your modified form, suppose you would get into litigation with the Alabama Power Co., as you probably would, you would contend, I suppose, that as a matter of law the contract that the Government has with the Alabama Power Co., giving the Alabama Power Co. the right to purchase the Government's interest in the property is null and void?

Mr. MAYO. Yes, sir.

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The CHAIRMAN. That is your contention?

Mr. MAYO. Yes, sir; based on the opinion of the Judge Advocate.

The CHAIRMAN. Suppose you should be defeated in that in court, and the court should hold that that was a valid contract, and that the Alabama Power Co. was entitled to have it carried out according to its terms, wht would happen then?

Mr. MAYO. Well, if that is the only alternative we would have to sell it to them, I presume, according to the contract.

The CHAIRMAN. Then, if it was sold to them according to the contract, Mr. Ford would get the money for the Government's interest instead of the Government getting it.

Mr. MAYO. Yes, sir.

The CHAIRMAN. If the contract failed and the Alabama Power Co. bought it, the money or the value of it, as it would be determined by the court, would be paid to Mr. Ford?

Mr. MAYO. Yes, sir.

The CHAIRMAN. Well, have you any idea as to its value? Could you give the committee your judgment as to what the value of the Government's interest in the Gorgas plant is?

Mr. MAYO. I don't think that I can. I have not made a close inspection of it.

The CHAIRMAN. Have you looked it over any?

Mr. MAYO. Only once; yes, sir.

The CHAIRMAN. Do you know what the Government put into it?

Mr. MAYO. I think it was approximately $5,000,000.

The CHAIRMAN. It would not be worth $5,000,000, would it?

Mr. MAYO. No, sir.

The CHAIRMAN. I suppose it could be duplicated now for less than the Government paid.

Mr. MAYO. My guess would be that you could buy it now probably for three-fourths of what it oridinally cost, at least.

The CHAIRMAN. Does your estimate include the transmission line from Gorgas?

Mr. MAYO. Anything they may have which is now owned by the Government. I am just estimating that they probably paid 25 or 30 per cent more during the war-time period than they would have to pay to-day.

The CHAIRMAN. Now, this modified form you have here provides that at the end of a hundred years this company or corporation organized by Mr. Ford shall have the preferred right to re-lease it or buy it?

Mr. MAYO. Re-lease the power.

The CHAIRMAN. Re-lease the power?

Mr. MAYO. Yes, sir.

The CHAIRMAN. In other words, at the expiration of the lease period, if the Government leases it again to anybody the Ford Co. shall have preference?

Mr. MAYO. Yes, sir.

The CHAIRMAN. Do you think that provision would be binding, as a matter of law, on the Government?

Mr. MAYO. Well, I think that is in accordance with practically all the decisions in the water-power act. Am I right in that, Mr. Waldo?

Mr. WALDO. Yes.

Mr. MAYO. Practically the same.

The CHAIRMAN. Would you not gather from that, then, if the court would uphold that contract, the court would likewise uphold the Alabama Power Co.'s contract with the Government, which provides that when the war is over and the Government does not need it any more, then shall sell the Government's interest to the Alabama Power Co.?

Mr. MAYO. Well, we have written in here "as prescribed by Congress," so we take whatever Congress may prescribe at that time.

The CHAIRMAN. Yes; at the end of a hundred years.

Mr. MAYO. Yes.

The CHAIRMAN. Yes; but you would not think, would you, that Congress, under that kind of a contract, would have a right to completely nullify it by passing an act saying that Mr. Ford's company should not be considered at all, and it could be sold to somebody else at the end of a hundred years.

Mr. MAYO. I should think that they would have to consider us, but they have the right to do whatever they please.

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The CHAIRMAN. Then, that does not mean anything to Mr. Ford or his company, does it, if Congress can say notwithstanding that kind of contract it is going to disregard it?

Mr. MAYO. Well, I think they can.

The CHAIRMAN. Laying aside the legal proposition, and suppose that Congress at the end of a hundred years, or at any time between this time and a hundred years from now, should say, "We have made this contract with Mr. Ford, but we are going to violate it, and we now pass a law which says that this company shall not be considered at all in a re-leasing of the property"—would that be anything that the Congress morally would have a right to do, even though they could do it legally?

Mr. MAYO. No; I think they should follow the letter of the contract.

The CHAIRMAN. Then, why would not the same reasoning apply to the Alabama Power Co. in this contract? Even though technically we could avoid it, why should we not make good on the contract?

Mr. MAYO. I don't know but that you would have made it good in passing it over to Mr. Ford just as it is. He is acting in the capacity of your agent——

The CHAIRMAN. That may be. I am not disputing that, Mr. Mayo, at all; but the Government has made a contract with the Alabama Power Co. that at the end of the war the Government would give its interest or sell its interest to the Alabama Power Co., and the contract provides how the amount shall be agreed upon. If we turn this over to Mr. Ford, we violate that contract. You say that as a matter of law it is no good, anyway. Now, the question is, How about it morally? Ought the Government to take advantage of a technicality, even though it could?

Mr. MAYO. Well, I don't know that I have enough of a legal mind to argue the technicalities of their contract.

The CHAIRMAN. It is not a legal question at all. There is no technicality of law involved in it. Let me ask you another question. Why does Mr. Ford want the Gorgas plant? You must see, it must be perfectly apparent to you, that you are getting Congress at least into a very difficult place if they undertake to turn Gorgas over to you. Why does he want it? It is not connected or necessary, as I can see, to the development of Muscle Shoals or anything connected with it.

Mr. MAYO. Well, it is the cheapest source of steam power to supplement the primary power.

The CHAIRMAN. Well, it would be the cheapest power, probably, because it is right at the coal mine——

Mr. MAYO (interposing). Yes, sir.

The CHAIRMAN (continuing). Until you developed power from the dams. You would have cheaper power then than Gorgas, even, would you not?

Mr. MAYO. After the dams are finished it is the cheapest source of supplementary power.

The CHAIRMAN. Would not Mr. Ford expect to operate the steam plants at nitrate plant No. 2, or either one of them?

Mr. MAYO. Yes, sir. The one at Gorgas is about half the size of the one at No. 2, and when the flow is diminished to an extent where it became necessary to use steam he would start Gorgas up first?

The CHAIRMAN. You would start up Gorgas first?

Mr. MAYO. Yes, sir; until your requirements called for the starting up of No. 2 plant.

The CHAIRMAN. There is a steam plant at nitrate plant No. 1?

Mr. MAYO. Yes, sir; but it is so small it hardly counts. You would operate Gorgas until your demand passed its requirements, and then start up the steam plant at No. 2.

Senator KENDRICK. Mr. Chairman, I wanted to ask the witness if it is not, in his opinion, almost certain to be true that the Alabama Power Co., situated as they are, with joint interest with the Government in the construction of this plant, would pay the Government a very much better and greater proportion of the cost of the plant than they could afford to do, even though the Ford company took over the Muscle Shoals. Is it not your opinion that the other people could afford to pay the Government a larger proportion of the cost than your company could?

Mr. MAYO. I don't know. We have made a certain offer. What they pay is entirely dependent on the contract, I presume.

Senator KENDRICK. Well, the geographical location of it would suggest that fact to be true.

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Mr. MAYO. I don't think it would be worth any more to them than it would to us, if that would answer your question.

The CHAIRMAN. Now, would you expect to get their part of the plant—their interest in the plant?

Mr. MAYO. Oh, no; only the Government's interest.

The CHAIRMAN. I know, but when you came to operate it, now, you could not practically operate with the Alabama Power Co. and the Government scrambled together as it is now.

Mr. MAYO. We think so.

The CHAIRMAN. Have you an understanding with the Alabama Power Co.?

Mr. MAYO. No, sir.

The CHAIRMAN. You would have to have that?

Mr. MAYO. We would have the same understanding that the Government now has in its contract with them.

The CHAIRMAN. But you are going to violate this contract, or you want us to violate the contract that the Government has with the Alabama Power Co. If you are going to enforce that you would have to sell to them.

Mr. MAYO. We do not have to sell until a certain period has passed in any event and we can at least operate as long as the contract allows us to.

The CHAIRMAN. Well, according to their contract. Now, have you contemplated this, that when the Ford Co. got this Gorgas plant, if you would make a deal with the Alabama Power Co. by which you simply sell to them after you had completed the dam?

Mr. MAYO. I think the preferable way would be to make some arrangement with them to operate it for us.

The CHAIRMAN. If Congress accepted your proposition you would have authority, would you not, to sell to the Alabama Power Co., must, as the Government does not, or in any other way that you and the company might agree?

Mr. MAYO. We would have only the authority the contract gives us, but the plant is of more value to us, or surely of as much value after the dams are finished as it will be at the start, because it supplements our low-water period.

The CHAIRMAN. The difficulty is that the property is all intermingled, all built on the Alabama Power Co.'s land, even including the transmission line, which is on their land. Every building is on their land, and they own the coal mine. The houses constituting the homes for the men are all intermingled and some of the houses owned by the Government and the machinery inside owned by the company, or vice versa, all mixed up. If you owned the Government's interest, which you would if we accepted your proposition, you could not divide the output of it without the Alabama Power Co.'s consent. There is no such agreement between the Government and the Alabama Power Co. in the Government's contract.

Mr. MAYO. I understand.

The CHAIRMAN. If you made that kind of an arrangement it would be because you made a new contract with the Alabama Power Co., and if they refused to go into partnership with you, then you would have to buy them out or they would have to buy you out, wouldn't you?

Mr. MAYO. Yes, sir. We have no fear of that at all.

The CHAIRMAN. Would it not be profitable, from your proposition that you are taking up here? You get that, and you don't pay the Government for it, excepting that it constitutes part of the property that is transferred to you and you then sell it to the Albama Power Co. They would be willing, to save I presume, litigation and trouble, to pay you a good deal of money for it—perhaps more than is provided in the contract they shall pay the Government, and there would be nothing to hinder you from doing that. I would like to know whether in any of your negotiations between yourselves that has ever been contemplated, and whether that is not liable to happen if Ford gets it.

Mr. MAYO. The reason we want it is for its power.

The CHAIRMAN. I know.

Mr. MAYO. We don't want it to sell.

The CHAIRMAN. Yes; I know that, but you have some difficulties when you get it, that either you have to sell, as I look at it, or they would have to sell.

Mr. MAYO. I don't think so, Senator. There is no reason why we could not make a satisfactory working arrangement.

The CHAIRMAN. Probably, but it looks queer to me, now, if you have made no preliminary arrangement with them about agreeing to such a division, and are buying it without having such agreement. It seems to me if I were buying into that kind of a mixed up, scrambled affair, before I would count very much

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on it I would want to make arrangements with the other fellow to see whether we could not agree on a division of the power, and if we could not I would not buy it.

Mr. MAYO. I am sure Mr. Ford would act justly in the matter.

The CHAIRMAN. Yes; but the other company may be unjust.

Mr. MAYO. Then, they will take the consequences.

Senator HARRELD. Does not that contract provide for an arbitration—I mean the appointment of arbitrators to determine how much the power company shall pay the Government?

Mr. MAYO. Yes, sir.

Senator HARRELD. If it was assigned to you folks, you would be bound by that arbitration?

Mr. MAYO. Certainly.

The CHAIRMAN. He contends, Senator—he made this statement before you came in, that the contract is nul and void—that is, I understand Mr. Ford's contention is that that contract is nul and void and of no legal effect.

Senator HEFLIN. How much money was invested by the Alabama Power Co. in the Gorgas plant?

Mr. MAYO. I understand about $5,000,000.

Senator HEFLIN. About the same as the Government?

Mr. MAYO. Oh, in their plant? No; I don't know, Senator.

Senator HEFLIN. You stated a while ago that the Government had invested $5,000,000.

Mr. MAYO. Yes, sir.

Senator HEFLIN. I want to know how much the Alabama Power Co. put into the project.

Mr. MAYO. I have no idea.

The CHAIRMAN. There is one question involved here as a matter of safety to the Government. Mr. Mayo, don't you think that if the Government makes a lease to anybody of any of this property that it has down there, it ought to provide that the company or person would not have any right to sell it or dispose of it without the consent of the Government?

Mr. MAYO. I don't know that I am prepared to say. I think if we should fulfill our contract, or step into the Government shoes in regard to the contract, that should be sufficient.

The CHAIRMAN. Would you have any objection to further modifying your proposition here to provide that you have no authority to sell to the Alabama Power Co. or anybody else any of the property transferred to you, but you must utilize it for the purposes of the lease—without consent, of course, from the Government?

Mr. MAYO. I would not think so. I am, however, not prepared to take a definite stand on that.

The CHAIRMAN. Has Mr. Ford discussed with his engineers, like yourself, the terms of this lease? You are insisting on 100 years?

Mr. MAYO. Yes, sir.

The CHAIRMAN. Everybody else proposes 50 years.

Mr. MAYO. Yes, sir.

The CHAIRMAN. And the law provides for 50 years?

Mr. MAYO. Yes.

The CHAIRMAN. Another thing I want to ask about it. Your proposition does not contemplate the manufacture of nitrates at nitrate plant No. 1?

Mr. MAYO. Well, we don't know. That may or may not be used——

The CHAIRMAN. As I looked through this modified proposal there was not any intention to manufacture nitrates at that plant.

Mr. MAYO. We do not agree to in the offer. We do not bind ourselves to do it.

The CHAIRMAN. You haven't any intention of making nitrates at plant No. 1, have you?

Mr. MAYO. Well, we may.

The CHAIRMAN. Is that true?

Mr. MAYO. Yes, sir.

The CHAIRMAN. Well, would you not be will to obligate yourselves to make nitrates in No. 1?

Mr. MAYO. No, sir.

The CHAIRMAN. You would not be willing to do that?

Mr. MAYO. No, sir.

The CHAIRMAN. Are you a chemist, Mr. Mayo?

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Mr. MAYO. No, sir.

The CHAIRMAN. Well, you know, in a general way, that nitrate plant No. 1, down there, was designed to get nitrates from the air by what is known as the Haber process?

Mr. MAYO. I am quite familiar with it; yes, sir.

The CHAIRMAN. And that nitrate plant No. 2, the one you propose to operate, it gets it from the air by the cyanamid process?

Mr. MAYO. Yes, sir.

The CHAIRMAN. And that the Government officials in building nitrate plant No. 1 were mistaken as to the machinery, and that that plant, as far as the machinery being able to get nitrates out of the air is concerned, has been a failure?

Mr. MAYO. Yes, sir.

The CHAIRMAN. And that it would take about a million and a half dollars to put it in shape so it would work?

Mr. MAYO. From that to three million.

The CHAIRMAN. From that to what?

Mr. MAYO. Three million.

The CHAIRMAN. From a million and a half to about three million, you think?

Mr. MAYO. Yes, sir.

The CHAIRMAN. Whatever it would take, if it were equipped, it would be a cheaper process than that at nitrate plant No. 2, would it not?

Mr. MAYO. Well, that is doubtful.

The CHAIRMAN. Is it?

Mr. MAYO. The modified Haber process theoretically will make it cheaper, but the question is whether it is safe.

The CHAIRMAN. Of course, I am not a chemist either, Mr. Mayo, but I formed that opinion from what our experts tell us. I formed the opinion that they had agreed, practically, that the Haber process is the only one that offers the most promising aspect for the securing of nitrates. Do you get that idea from your study of the question?

Mr. MAYO. Theoretically it promises greater returns; yes, sir; but you are still, even with a modified apparatus, dealing with high pressures and high temperatures, both of which are more or less dangerous and deleterious to materials, and, further, it is a complicated process.

The CHAIRMAN. Do you agree with the scientific men when they say that the prospect of improvement is more apt to be with the Haber process than with the cyanamid process?

Mr. MAYO. There is nothing sure that we will confine ourselves to the cyanamid process.

The CHAIRMAN. No. I am not taking that up now.

Mr. MAYO. I see.

The CHAIRMAN. I would like to get your judgment on that.

Mr. MAYO. The possibilities are greater; yes, sir.

The CHAIRMAN. Then, I would like to know why Mr. Ford has obligated himself to extract nitrates from the air by the process that, from all we can find out now, from scientific men, is not as good a process as the one he will not operate or will not obligate himself to operate for nitrates?

Mr. MAYO. Maybe you are mistaken in what he offers. He does not obligate himself to operate nitrate plant No. 2 under the cyanamid process. He merely agrees to operate that plant at a certain capacity.

The CHAIRMAN. What process is he going to use there if he does not use the cyanamid process?

Mr. MAYO. He is not prepared to say, but he will have to equip it for whatever process he uses.

The CHAIRMAN. Do you mean to say he has some secret method that he is concealing that he is going to use?

Mr. MAYO. Yes, sir. Surely.

The CHAIRMAN. Well, I did not get that from the contract.

Mr. MAYO. If you will read the paragraph, you will see that he simply guarantees to operate that plant to a certain capacity.

The CHAIRMAN. I assumed from that that he was going to use the process for which the plant was designed.

Mr. MAYO. Not necessarily; no, sir.

The CHAIRMAN. In fact, I judge from what you say now he does not intend to use the cyanamid process?

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Mr. MAYO. I don't think he will. He may start with it and later change to another process.

The CHAIRMAN. Will you give the committee an idea what the other process is, and what he proposes to do.

Mr. MAYO. I don't think I can, because it is in more or less of a partly perfected process, and there are a number of possibilities that we are working out. It is a little too early to state publicly what it is.

The CHAIRMAN. Can you give the committee this much information, that Mr. Ford, under that provision of the contract, does have in mind some other secret process that he expects to use instead of the cyanamid process?

Mr. MAYO. Yes, sir; and the process, we think, will be much safer and fully as cheap, if not cheaper, than the Haber process.

The CHAIRMAN. At the present time that is a secret?

Mr. MAYO. Yes, sir.

The CHAIRMAN. Will the capacity of your plant be as great under the Ford process that he expects to use as it is now under the cyanamid process?

Mr. MAYO. I think he will operate at a greater capacity; but he guarantees to operate at that capacity, anyway.

The CHAIRMAN. You feel under the proposition that he is obligated to make, then, at least 110,000 tons of nitrate a year?

Mr. MAYO. Yes, sir.

The CHAIRMAN. At that plant?

Mr. MAYO. Yes, sir.

The CHAIRMAN. That is its capacity.

Mr. MAYO. Its nitrogen capacity is equal to 110,000 tons of ammonium nitrate, and he sets that up as the equivalent.

The CHAIRMAN. Will Mr. Ford's secret process require as much power as this does?

Mr. MAYO. I don't think as much; no, sir.

The CHAIRMAN. How much less?

Mr. MAYO. We are not sure yet. It is being worked out to dovetail in with other manufacturing processes that are to be used in our own business.

The CHAIRMAN. What does Mr. Ford expect to use nitrate plant No. 1 for?

Mr. MAYO. Well, he is not sure. We are feeling our way in working out our complete plan.

The CHAIRMAN. Can you give the committee any idea as to how much power, under this new or secret process that Mr. Ford has, will be required to make 110,000 tons a year?

Mr. MAYO. I could not say offhand. As I say, it dovetails into other manufacturing processes.

The CHAIRMAN. What do you mean by dovetailing in?

Mr. MAYO. I mean the by-product of the one is the product of the other.

The CHAIRMAN. Can you give the committee any information as to what the other products are, whether by-products or otherwise, that you expect to make in the process?

Mr. MAYO. They will be electric furnace steels and aluminums.

The CHAIRMAN. Aluminums?

Mr. MAYO. Yes.

The CHAIRMAN. Well, I have been wondering, Mr. Mayo, why it is that, representing Mr. Ford, you are not willing to take the committee and the Congress into your full confidence and let them know just exactly what you expect to do with this power if you get it. It might make a great deal of difference, I should think, in the consideration of the proposition by Congress. Have you any objection?

Mr. MAYO. No objection to that at all, other than we are working out a program that we do not want to give the full information on until it is fully worked out.

Senator MCNARY. Mr. Mayo, may I make this remark at this place: I read in the hearings in the House, or some other document that I thought was official from the Ford standpoint, he intends to use nitrate plant No. 1 for manufacturing purposes, both in the creation of automobiles and spare parts that are being used in automobiles. Is not that part of the record?

Mr. MAYO. I think I made the statement that we would probably use nitrate plant No. 1 for manufacturing raw materials for automobile parts, but there is nothing very definite in that.

Senator MCNARY. I thought the statement was made, anyhow, and I thought it was made by you also.

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Mr. MAYO. Yes, sir.

Senator HARRELD. You do reserve the right to use this power for anything you want to use it for except the part from which you agree to make nitrates, otherwise you reserve the right to use the power for any kind of manufacturing purposes?

Mr. MAYO. Yes, sir.

Senator HEFLIN. Mr. Mayo, one of your reasons for not giving this secret process that you have in mind for making nitrate is, I suppose, that you have not yet submitted it for patent, and you are not yet ready to disclose to the public just what it is you have got?

Mr. MAYO. Not only that, but we have not formulated our definite plans, and we do not want to describe what you might call a tentative arrangement.

Senator MCNARY. Mr. Mayo, is the Ford Co. doing research work through laboratories looking to the creation of a new process?

Mr. MAYO. Yes, sir.

Senator MCNARY. The Government is doing it there under the direction of the Department of Agriculture?

Mr. MAYO. Yes, sir.

Senator MCNARY. Are you familiar with the arc process?

Mr. MAYO. Yes, sir.

Senator MCNARY. Are you considering that in connection with the work you are doing?

Mr. MAYO. We have considered it, but it takes so very much more power than the other processes it is hardly possible we will use it.

Senator MCNARY. Then you have eliminated any further consideration of the arc process?

Mr. MAYO. I would not say fully eliminated it.

The CHAIRMAN. Does it take more power than the cyanamid process?

Mr. MAYO. Much more. It is the most expensive power user there is up to date.

The CHAIRMAN. So that to make it by the arc process, so far as it is known now by scientific men, one of the prerequisites would be the very large amount of cheap power?

Mr. MAYO. Yes, sir.

Senator MCNARY. Don't you make nitrate of soda through the arc process, which you can not do through the cyanamid and Haber processes?

Mr. MAYO. No. It is a shorter cut method. You make nitric acid.

Senator MCNARY. With the blending of oxygen and nitrogen you get nitrate of soda, which is the complete fertilizer?

Mr. MAYO. It takes very much more power. My understanding the product is nitric acid.

Senator MCNARY. You have a complete fertilizer, though, in the product?

Mr. MAYO. It takes about five times as much power, and does not make a complete fertilizer as I understand it.

The CHAIRMAN. Paragraph 15 of the modified Ford proposal reads as follows:

"The company agrees to operate nitrate plant No. 2 at the approximate present annual capacity of its machinery and equipment in the production of nitrogen and other commercial fertilizers (said capacity being equal to approximately 110,000 tons of ammonium nitrate per annum) throughout the lease period, except as it may be prevented by strikes, accidents, fires, or other causes beyond its control."

Now, that is the only provision in your proposition, is it not, Mr. Mayo, by which this Ford Co. is bound to manufacture nitrates as fertilizers?

Mr. MAYO. I think so.

Senator HARRELD. Suppose you can not run it economically enough to compete with some other factories producing the same thing; would you continue to run it just the same under the terms of that contract?

Mr. MAYO. Well, we surely, with the low cost of power, could make it as cheap as anybody else.

Senator HARRELD. Suppose somebody else invented a process by which they could do it more cheaply than you could and patented that process and thus made it unprofitable for you to run to make nitrates, what would be your relief under the terms of this contract under that condition?

Mr. MAYO. I think, as I said to the House committee, that after Mr. Ford had exhausted every possible effort and proved beyond any question of doubt that he could not run in any other way but at a loss he could come to Congress and get some relief.

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Senator HARRELD. The contract itself does not provide for that, does it?

Mr. MAYO. No, sir. As you will see by this offer, he agrees to run a research department, in which he expects to keep at least abreast of the times, and he further agrees to employ any improved method that can be found. That, together with the natural resources there, insures a minimum cost.

Senator HARRELD. He does agree, so far as the terms of the contract are concerned, unequivocally, to using the full power of plant No. 2 to make nitrates, does he not?

The CHAIRMAN. To its capacity.

Senator HARRELD. I say to its capacity.

The CHAIRMAN. Present annual capacity of its machinery and equipment.

Senator HARRELD. What about the capacity of the water power?

Mr. MAYO. He simply agrees to operate at a minimum capacity of, or the equivalent of, 110,000 tons of ammonium nitrate, which is its present plant capacity.

Senator HARRELD. I see. He can substitute the other power if he wants to?

Mr. MAYO. Yes, sir.

The CHAIRMAN. Oh, yes. He can do it all by steam if he wants to.

Senator HARRELD. I see the point.

The CHAIRMAN. But if he used a higher priced power he would have to charge more for the fertilizer, would he not?

Mr. MAYO. Yes, sir.

The CHAIRMAN. As we construe your amended proposition now, would there be anything to prohibit him from using the cheaper power or selling it or making aluminum or automobiles or some other kind of products with it and then making fertilizer out of high-priced power, and, therefore, raising the price of fertilizer higher than he otherwise would if he made it out of cheap power?

Mr. MAYO. I would say he would be morally bound to use the cheapest power for the fertilizer.

The CHAIRMAN. What provision of the contract would require that? The point is, Mr. Mayo, he might make fertilizer out of high-priced power and add that cost of power to the price of the fertilizer itself and utilize the cheapest power for commercial enterprises for his own benefit.

Senator HARRELD. Is it likely that plant No. 2 would just be turned over to make nitrates for fertilizer and all the rest of the power used for commercial purposes? Is not that likely what would happen under the terms of the contract?

Mr. MAYO. I think not. If we are successful in what Mr. Ford plans to carry out, I am of the opinion that the fertilizer capacity will be two or three times what he has agreed to here.

Senator HARRELD. If that rule is adopted and followed, it would make fertilizer higher than it would be if he would use the water power, would it not, carrying out your point?

Mr. MAYO. Well, that question has never been brought up before and never entered our minds. The whole object was to use the cheapest power.

Senator HARRELD. Our object is to get cheap fertilizers to the farmers, if we can.

Mr. MAYO. Yes, sir; and that is Mr. Ford's object also.

The CHAIRMAN. We have just two objects in view. One is to get cheap fertilizers and the other is to be prepared to make explosives in time of war.

Mr. MAYO. Yes, sir. That plan is what he has tried to carry out—that idea—in this offer.

The CHAIRMAN. He agrees in this contract that he will not make more than 8 per cent on the fertilizer?

Mr. MAYO. Yes, sir.

The CHAIRMAN. Now, if he could improve the process—and all scientific men think that it is going to be improved, although nobody, as you say, can tell just how——

Mr. MAYO (interposing). No, sir.

The CHAIRMAN. Although all the studies of our scientists seem to indicate that the Haber process is the one that offers the best field for improvement.

Mr. MAYO. Yes.

The CHAIRMAN. Mr. Ford's contract would provide that he could not make more than 8 per cent on the cost of fertilizer.

Mr. MAYO. Yes.

The CHAIRMAN. If he has the use of his power there to sell to somebody else or engage in commercial operations with, and had several grades of power, and

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some of it went cheaper than others, he could utilize the cheapest power in his commercial operations and the most expensive power in his fertilizer operations, and the result would be, so as to make 8 per cent profit on the fertilizer operations, we would have as a result the fertilizer sold to the farmers for much more money than if it was made out of the cheapest power. Could not that happen under this proposal?

Mr. MAYO. It might possibly happen. As I say, that question has never been brought up before.

The CHAIRMAN. It may never occur, and I assume at the beginning you would have to use the cheapest power you have—perhaps the water power—to make fertilizer; but if you did improve it, as everybody hopes you will if you get it, and it was made much cheaper, so that you could make it out of more expensive power and still be able to sell it on the market, then in that case would it not be to your financial benefit, and would you not naturally expect that this company, trying to make all the money it could, which would be perfectly legitimate under this contract, would make fertilizer out of the higher-priced power and use the lowest-priced power for commercial operations, where they would get the money out of it?

Senator HARRELD. Thus defeating the purpose of making cheap fertilizers for the farmers?

The CHAIRMAN. Yes.

Mr. MAYO. Of course, we say in our offer that the farmers may be supplied with fertilizers at fair prices, without excessive cost, and so on; but laying all that aside, if there is any question in our wording here that we may possibly not use the lowest-priced power for the fertilizer product, we are willing to clarify it and make it perfectly clear.

The CHAIRMAN. I am glad to hear you say that.

Senator HARRELD. The point is, we want the public to benefit from his laboratory experiments.

Mr. MAYO. We have made every effort to so word this offer that the fertilizer end of the business and the stand-by condition of the plant for Government use in time of emergency are the two prime objects.

The CHAIRMAN. You would be willing to put a provision in there that in charging up the cost of the fertilizer you should count the cost of the power at not to exceed the cheapest power you have there? You could use any kind of power you wanted, I suppose.

Mr. MAYO. Of course, the secondary power, it goes without saying, is your cheapest power. There is a time when you have no secondary power and you are using nothing but primary power. If you are confined to using what you might strictly term as your cheapest power, you could only operate on your secondary.

The CHAIRMAN. That would mean if you operated exclusively on the secondary you could not operate all the time?

Mr. MAYO. Yes. It may not be good business to shut down during the period there was only primary power available.

The CHAIRMAN. On the other hand, it may be by coordinating these different power facilities there that very considerably, in your case—coordinate them all—you could perhaps most economically make fertilizer out of secondary power, because it would not be like a street railway or lighting system. There might be a season of 30 days in the year when you would want to shut down, let your employees have a vacation, and look over the machinery. Under the power developed by Dam No. 2, and later on by Dam No. 3, that would give you an opportunity to operate it by secondary power, which, as you say, is the cheapest there is.

Mr. MAYO. Well, Senator, we are glad you brought that point up, and we will clarify it so it will satisfy you, I am sure.

The CHAIRMAN. To my mind, it is quite an important proposition.

Mr. MAYO. I think so, too.

The CHAIRMAN. I am assuming, and we all are assuming—we may be all wrong, of course—that whoever gets this, or if the Government does it, we are going to improve this process. In fact, if I did not think it would be improved by the Yankee mind I would not take the interest in it that I am taking in it.

Mr. MAYO. There is no question about the improvement. There are several roads to follow. It is perhaps a little difficult to decide which road we will travel until our process is more definitely fixed.

The CHAIRMAN. Yes; and you may have to travel one road and stop and go up the other one.

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Mr. MAYO. Exactly so.

Senator HEFLIN. But you do intend to manufacture fertilizers and to sell them cheaper to the farmer than he is buying them to-day?

Senator HARRELD. I don't think that is the question, whether he sells cheaper than they are buying to-day. The question is, the public is entitled to fertilizer at the cheapest possible price.

Mr. MAYO. The public is entitled to the fertilizer as cheaply as we can make it out of the best process that we can develop plus 8 per cent profit.

Senator HARRELD. That is it.

Senator HEFLIN. The trust fixes the price of fertilizer to-day, Mr. Mayo, and they absolutely rob the farmers at the prices that it charges. I understand it is the purpose of Mr. Ford to manufacture fertilizers cheaper, so that the farmer will be able to buy fertilizers cheaper than he can buy them now under the trust control. Is not that the purpose?

Mr. MAYO. Well, offhand, we think we could make fertilizer at about half the price it is sold for to-day.

The CHAIRMAN. Now, Mr. Mayo, I think one of the two objects Congress has in view is to do not only that, but to go further and to adopt whatever improvements may be made to still cheapen the product; in other words, at all times to make fertilizer as cheaply as it can be made by the use of the cheapest power we have down there.

Mr. MAYO. That is the sole purpose of this offer.

The CHAIRMAN. That is Mr. Ford's object; but we want to—and very properly, without casting any reflection whatever upon you or Mr. Ford either one—to see that is in the contract, because Mr. Ford is going to die long before this contract is carried out.

Mr. MAYO. Yes, sir.

The CHAIRMAN. And all people who are alive now will be dead before that time, and our posterity is going to handle the question; so it is just as important that we bind anybody that gets this up by contract that will go into every detail and protect the public in every possible way—just as much so as though we were dealing with somebody in whom we had no confidence at all, I think, because we know that the men we are dealing with now are not going to be the men that will carry out this contract.

How old is Mr. Ford?

Mr. MAYO. Fifty-eight.

The CHAIRMAN. He is about my age, and we will be shuffling off about when he does, and it is liable to happen any day. In fact, we ought to hurry this up, so as to get it through before we go. The great bulk of this contract is going to be carried out after he is dead and you are dead and I am dead.

Mr. MAYO. I think before he passes out he will probably make arrangements for an operating plan that this company will have to adhere to, which will please the public.

The CHAIRMAN. He can not do that unless it is in the contract with the Government. Those who succeed him can even change their articles of incorporation and have entirely different management of the corporation. It may be just the reverse.

Mr. MAYO. It all depends on how he leaves it, I guess.

The CHAIRMAN. The only way to protect the Government and Mr. Ford is to put it in the contract so that it can not be changed without the consent of the Government.

Mr. MAYO. The offer sets out here that he agrees to a minimum capacity, for one thing, and that he shall make fertilizer, for another, and further that the price is always under the control of the Agricultural Department of the Government and the farmers' organizations. So it is pretty well tied down, it seems to me.

The CHAIRMAN. Would Mr. Ford, or you representing Mr. Ford, consider any change in the proposition by which the time of this lease should be cut down from a hundred years?

Mr. MAYO. No, sir. We have talked over that to great length, and——

The CHAIRMAN. You would not consider a shortening of the period?

Mr. MAYO. No, sir. The project is so very large that Mr. Ford's investment would be much more than the Government's before he gets through.

The CHAIRMAN. As I understand his proposition, his investment could not be as much as the Government's.

Senator HARRELD. Oh, yes.

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Mr. MAYO. By the time we have built sufficient manufacturing plants down there to absorb the power, my judgment is that Ford will have expended at least $50,000,000.

The CHAIRMAN. Well, is that contemplated?

Mr. MAYO. Why, surely.

The CHAIRMAN. Then he does not intend to sell any of the power?

Mr. MAYO. No, sir. For a time, in all probability, when he will have to sell some.

The CHAIRMAN. He intends to use it for manufacturing enterprises?

Mr. MAYO. That is the main purpose; yes, sir. There will be a certain amount of power, probably, sold before he develops his plant sufficiently to absorb all the available power.

The CHAIRMAN. If there were manufacturing enterprises there all owned by Mr. Ford or his associates, up to the capacity of the power that would be developed in excess of what would be used to manufacture nitrates, it would, of course, be a mammoth undertaking.

Mr. MAYO. Exactly.

The CHAIRMAN. But in the meantime there is, I presume, a very large income coming in. You contemplate that, because you are going to have cheaper power than your competitors, in whatever business you go into, or very likely will, so your profit will be correspondingly large?

Mr. MAYO. Well, Mr. Ford is making automobiles, I think, cheaper than anybody else to-day; but he does not benefit by that. He sells the car at the lowest price.

The CHAIRMAN. I think he benefits by it, but he lets the rest of us poor fellows benefit by it also.

Mr. MAYO. He tries to.

The CHAIRMAN. He divides up, and that is the reason we like him.

Mr. MAYO. That is his plan.

The CHAIRMAN. But he is not doing it without any profit.

Mr. MAYO. Well, you can not operate successfully without profit.

The CHAIRMAN. He is making it all the time, and I am glad he is, and I don't want anybody to get this to make a financial failure of it. I want them to succeed. But it seems to me that while the fixing of the time is an arbitrary proposition, we have had it up so often in the Congress in the water power act—

Mr. MAYO. I know it.

The CHAIRMAN. —that 50 years is as long as the Government ought to lease anything of that kind, because of the awful uncertainty that we know is going to exist in 50 years from now, and that has been the policy of Congress.

Mr. MAYO. We are aware of that.

Senator HARRELD. If this magnanimous policy of Mr. Ford is carried out for 50 years I should think the public would be the last people on earth that would want to take it away from him at the end of 50 years.

Mr. MAYO. Of course, this is not a water-power project strictly. It is a combination of water power and a large industrial project hooked together. So it is in a different class than the ordinary water power.

The CHAIRMAN. Then you would not consider the proposition of a 50-year lease with a provision in it, as we do under the general law, of a preference right to a re-lease for another 50 years in case the Government did not want to take it over?

Mr. MAYO. No, sir. Mr. Ford has stood fast on the hundred years from the start.

The CHAIRMAN. Now, there is another theory I would like to get your views on.

Mr. Ford's proposition would be to utilize this power in his commercial operations and manufacturing operations?

Mr. MAYO. Yes, sir.

The CHAIRMAN. He will not sell any of this power to municipalities over transmission lines, etc.?

Mr. MAYO. He would not want to see any power go to waste, so, for the period he was building up his plant and it would naturally go to waste, he would, of course, want to sell it.

The CHAIRMAN. While he was building up his enterprise he might do that?

Mr. MAYO. Yes, sir.

The CHAIRMAN. I mean as a permanent policy?

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Mr. MAYO. That is not his intention.

The CHAIRMAN. There is another theory of utilization of water power in navigable streams that it ought to be spread over the public, given to the public and municipalities and States, etc., in preference to private corporations?

Mr. MAYO. Yes, sir.

The CHAIRMAN. The acceptance of Mr. Ford's proposition would prohibit the use of any power developed on the Tennessee at Muscle Shoals from being put to that use?

Mr. MAYO. There are a lot of other chances for water power on the Tennessee that might be used for that purpose.

The CHAIRMAN. That reminds me. Have you ever given any consideration to that? I wish you would take it up with the committee. What is Mr. Ford's idea about, for instance, the building of reservoirs? Has he considered that subject?

Mr. MAYO. Oh, yes.

The CHAIRMAN. Have you, as an engineer, gone over the country to see whether there are places where at reasonable cost you could get reservoirs on the Tennessee or its tributaries?

Mr. MAYO. I have not gone over the country, but I have gone over the maps and the history of the watershed.

The CHAIRMAN. What is your judgment about that? I am confining my remarks now to the tributaries of the Tennessee—the Tennessee and its tributaries.

Senator HARRELD. The watershed of the Tennessee?

Mr. MAYO. Mr. Ford assumes, if he gets this project and he creates a demand for the greater part of this power, he will then turn his attention toward other storage reservoirs to increase his primary power.

The CHAIRMAN. He would have to secure additional legislation to do it, would he not?

Mr. MAYO. Yes, sir. He is willing to let that stand on its own bottom when he comes to it.

The CHAIRMAN. What is your judgment about the possibilities in that respect?

Mr. MAYO. I think the possibilities are very great.

The CHAIRMAN. Are they?

Mr. MAYO. Yes, sir.

The CHAIRMAN. Of course, if that could be done it would be a wonderful increase of power and it would cheapen all the power very much.

Mr. MAYO. It not only can be done, but, personally, I think it is the only thing to do.

The CHAIRMAN. How much primary power do you figure, without any storage dams, will be developed at Dam No. 2?

Mr. MAYO. About 100,000 horsepower. The minimum year is down around 90,000 horsepower.

The CHAIRMAN. Now, then, how much additional secondary power can be developed there, where the power will be obtainable at least six months in the year?

Mr. MAYO. About 400,000 horsepower over a six months period.

The CHAIRMAN. And that would be about as much of secondary power as you could count on being valuable, would it not? If that is not right, how much, in your judgment, would it be?

Mr. MAYO. About one-third of your secondary I would consider.

The CHAIRMAN. You mean only four months?

Mr. MAYO. Not four months, but one-third of the amount that is available for six months.

The CHAIRMAN. I don't understand just what you mean. Of course, secondary power depends for its value on its approach to primary power?

Mr. MAYO. Yes, sir.

The CHAIRMAN. Now, then, how many months in the year do you think secondary power would be valuable? I mean, now, when I say six months, that six months of the time they have not the power, and that unless you do reinforce it by other power there would be six months in the year when you would not have it. Would that secondary power up to six months be valuable?

Mr. MAYO. It, of course, all depends on how you could suit your business to it.

The CHAIRMAN. I can see it might make a vast difference.

Mr. MAYO. And while you have a certain amount of secondary power for six months, of course, you have slightly less for seven months, and still less for

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eight months. If you take the amount of your secondary power for six months and divide it by three, that third would be quite valuable.

The CHAIRMAN. You would operate a steam plant, now, with Dam No. 2, for eight months in the year?

Mr. MAYO. The steam plant would only be operated about two months.

The CHAIRMAN. Then your secondary water power that you would use would be running 10 months in the year?

Mr. MAYO. Yes, sir. I took the six months quantity of secondary power and divided it by three, which would give you the amount for about eight months that would have some value. Do you get that?

The CHAIRMAN. No, I don't, Mr. Mayo. I don't quite understand you. I don't know that it is very important. I want to get this idea. For ordinary purposes, how much of the secondary power in the ordinary run of business could a man expect to utilize down there? You have 100,000 horsepower that would run all the year around, the maximum power from the dam would run up to over a million, for about 7 per cent of the time, but everybody concedes if you had to have steam for 93 per cent of the time it would not be economical to use that secondary power. I want to get the line where we could use it, where we can afford to use steam power to reinforce it and make it primary power in ordinary business operations.

Mr. MAYO. As it is now planned, 100,000 horsepower is the minimum. During the 100,000 horsepower minimum period you would operate the steam plant as well. That would more than double up your primary power. You have 120,000 horsepower in steam. This would make 220,000 horsepower primary power (including steam auxiliary).

The CHAIRMAN. You mean to operate your steam at full capacity all the time?

Mr. MAYO. No, sir. You would operate the minimum period with 100,000 horsepower primary water and during the minimum period of 100,000 of water supplement it with 120,000 horsepower of steam; you would keep the 120,000 horsepower of steam running until the amount of secondary power rose above that point, and then you would shut down the steam plant and go on with the water power only.

The CHAIRMAN. Now, then, how long in the year, how many months in the year, the ordinary year, carrying out that same policy, would you operate your steam plant?

Mr. MAYO. I would say a maximum of three months, or maybe a minimum of two months.

The CHAIRMAN. That explains what I want to get at. Then, by doing that, running from a maximum of three months to a minimum of two, you would have primary power amounting to about 240,000 horsepower, would you not?

Mr. MAYO. Yes, sir; 220,000 to 240,000 horsepower.

The CHAIRMAN. All right, Senator Harreld. I believe you had a question.

Senator HARRELD. What I started to say is this, Mr. Mayo:

I am frank to say that the objection I have to this contract is the 100-year period. Over a period of 25 or 30 years past there has been a gradual tendency or growth to a sentiment, and a good deal of legislation, tending to control public utilities, and lately it has taken a turn in the Packers' cases, where there is a tendency to control by law the operations of private companies. I am frank to say that if Government control does not regulate those things the only alternative is Government ownership. I am not for Government ownership, but there is a possibility that within less than a hundred years Government ownership will be forced on the people of this country and public sentiment will be behind it, and whenever public sentiment gets behind it, it ought to prevail.

Mr. MAYO. Yes, sir.

Senator HARRELD. Whenever we make a contract of this sort our successors may find it very embarrassing before the hundred years is out. I hesitate to make that kind of contract any longer than that. That is the thing in this contract that sticks in my crop more than anything else.

Mr. MAYO. And it appears to me if this project came under the same class of business that the Government decided to take over, it would necessarily have to fall in the same boat, would it not?

The CHAIRMAN. It looks to me that this is a great deal nearer the class where there is justification for Government ownership, because certainly in one respect one of the principal objects, and without which we never would have done anything at Muscle Shoals, was entirely a Government proposition. That was the Haber process in time of war.

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Mr. MAYO. Yes, sir. Well, the Government, as I see it, is more or less of a partner in this project, if it goes to Mr. Ford, inasmuch as Mr. Ford agrees to keep an emergency plant there ready at all times, with its organization right up to date in the most improved state of the art, and it is up to the Government to see that he does it. He agrees to do it in his offer. He also agrees to keep right up on top of the state of the art in making fertilizer, and to make it as cheaply as he can, and he sets out a minimum quantity. The Government and the agricultural interests of the country sit in on that end of it to see that he does it. So that is possibly Government control, or very near it, I would say. You get all the benefit of Government ownership, with the private initiative of somebody who has operated a large business successfully for a long time to push it forward and bring about the very things we are looking for. It looks to me like a pretty good combination. As I have heretofore stated, if before the lease term expires, although he has purchased the nitrate plants, if at any time the Government takes over the ownership of this class of business, I see no reason why it would not have the same authority it would have in taking over any other company. The mere fact that the Government had sold this project to Mr. Ford, or sold him certain rights and interests, I don't think complicates it in any particular.

The CHAIRMAN. We will have to stop now. We will adjourn until 10.30 o'clock to-morrow morning.

(Whereupon, at 12 o'clock, noon, the hearing was adjourned to 10.30 o'clock a. m., Tuesday, May 2, 1922.)

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MUSCLE SHOALS.

TUESDAY, MAY 2, 1922.

UNITED STATES SENATE,
COMMITTEE ON AGRICULTURE AND FORESTRY,
Washington, D. C.

The committee met, pursuant to adjournment, at 10.30 o'clock a. m., in room 224, Senate Office Building, Senator George W. Norris (chairman) presiding.

Present: Senators Norris, McNary, Norbeck, Kendrick, Harrison, and Heflin.

The CHAIRMAN. The committee will come to order. You may go ahead, Mr. Mayo.

STATEMENT OF MR. WILLIAM B. MAYO—Resumed.

Mr. MAYO. In reference to the questions that you asked yesterday in regard to using the most economical power for making fertilizers: To overcome the objections you have stated, we have inserted the words in paragraph 15, after "nitrate plant No. 2," "using the most economical source of power."

The CHAIRMAN. Of course, Mr. Mayo, I would not have any objection to your using any kind of power, excepting that in the computation of the cost you would count it on the basis of the most economical power.

Mr. MAYO. I think this clarification would apply. That is our judgment.

The CHAIRMAN. I think that wording would cover that.

Mr. MAYO. Yes.

The CHAIRMAN. I realize if you had all these kinds of power sometimes you would be using all of them.

Mr. MAYO. Yes, sir.

The CHAIRMAN. And you might, as a matter of fact, be using the most expensive part for the fertilizer proposition, and that would be immaterial if, when you computed the cost on which you reckoned your 8 per cent profit, you counted it as though you had used the most economical power.

Mr. MAYO. That is, out of the total power used for the year's run we would figure the most economical power?

The CHAIRMAN. Exactly; yes, sir.

Mr. MAYO. In paragraph 15, also, in subdivision (*a*), in which we determine by research to ascertain all the improved methods we can find, we have added to that paragraph "and if so found and determined, to reasonably employ such improved methods."

There was some question before the House committee in regard to this research clause. We guaranteed to run a research department, but we did not guarantee to use any improved methods that we found, so we have added those words.

In paragraph 16 we struck out the words "at nitrate plant No. 2," in the third line. That was brought about by some question like, for instance, in regard to Waco quarry, which is really not a part of plant No. 2. All the limestone that we brought from there, or possibly any other source where we could mine phosphate rock, would not be a part of nitrate plant No. 2. So the words "nitrate plant No. 2" were stricken out, to include any fertilizer operations in the Muscle Shoals district.

Senator HARRISON. May I ask in that connection—I see you mention three organizations, namely, the American Farm Bureau Federation, the National Grange, and the Farmers' Educational and Cooperative Union of America. The American Farm Bureau Federation is the organization of which Mr. Howatt is the head, is it not?

Mr. MAYO. Yes, sir.

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Senator HARRISON. Then the National Grange and then the Farmers' Educational and Cooperative Union of America. Is that the one Mr. Barrett is head of?

Mr. MAYO. Yes, sir.

The CHAIRMAN. Is that right?

Mr. MAYO. I think that is right; yes, sir.

The CHAIRMAN. That is the farmers' union that he is the head of? Is this the same thing?

Mr. WALDO. Yes, sir.

The CHAIRMAN. What is the farmers' organization that Mr. Lyman represents? I wondered why you put in the names of these farm organizations. That is something that is changing continually. With the exception, perhaps, of the grange, they are comparatively new organizations, and there are other representatives of farm organizations now in Washington. It seemed to me when I read it over that that ought to be modified in some way, so as to make it more general.

Senator HARRISON. You have no objection to that?

The CHAIRMAN. I should not think so.

Mr. MAYO. Well, Mr. Ford's plan was to get the three representative organizations in the United States.

Senator HARRISON. You thought those were representative farm organizations and that is why you selected them?

Mr. MAYO. Yes, sir. Those were picked out, and they sat in with us in drawing this paragraph.

The CHAIRMAN. Of course, they would naturally be led to put themselves in, and I have not any objection to any of those organizations mentioned there; but when you get into operation there may be something entirely different. In fact, charges against one of these have been made on the floor of the Senate that it is controlled by men who are detrimental to the interests of farmers.

Mr. MAYO. I might add that those three organizations have taken in with them other minor organizations in discussing the paragraph.

The CHAIRMAN. I know there are other organizations that are very much interested, or at least in the past have taken quite an interest in this legislation.

Mr. MAYO. I think they have all sat in on it and had their say.

Mr. WALDO. They called a meeting to decide on those three.

Senator HARRISON. You would not object to a provision being put in there that, if desired, Congress might change the names of those at any time, would you?

Mr. MAYO. I don't think there would be any objection so long as you keep the three representative organizations.

The CHAIRMAN. You know time may disclose that instead of three representative organizations there may be more or there might even be less. There are times when all these organizations get together and other times when they do not agree.

Mr. MAYO. That is very true; and we thought if we picked three of whatever there might be, that would be a proper number.

The CHAIRMAN. In just the little time I have been in Congress here I have seen all these organizations except the Grange created, and here is a contract that is going to run for a hundred years.

Mr. MAYO. This reads "or their successors."

The CHAIRMAN. I agree with what I think you are trying to reach there, and consider it important to have on this board representatives of the farmers, whoever they may be, but it does not seem to me in a contract that is going to last a hundred years we ought to name them.

Mr. MAYO. That was the intention—to keep the three leading organizations, whatever they might be. That is the thought.

The CHAIRMAN. Another thing that very often happens: Take these three organizations you have named here; I am not making any charge against any of them, but, as I have said already, the charge has been made on the floor of the Senate, and it has received a great deal of publicity, and it has been denied, and been reasserted by others that it is true, that one of these organizations that is named here has been in secret meetings with various corporations which other people allege do not have the interest of the farmer at heart. These organizations were named here; and if there was any attempt made by special interests, the first thing they would attempt to do would be to get

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control of that organization, and they might get it. If they did, it would have just the opposite effect to what it is intended to have.

Senator HARRISON. The power is lodged in Congress to give them the right to change the representation, so far as those organizations are concerned. I should think that would satisfy that.

Mr. MAYO. I will study that over this evening and see if we can not make some further suggestion.

The CHAIRMAN. I think you get the idea, Mr. Mayo.

Mr. MAYO. I get your idea exactly.

The CHAIRMAN. And don't you think there is danger of that occurring—that interests that are not friendly to the farmers might get control of the management of this corporation 25, 50, or 75 years from now? The question might be very acute about these representatives, and these farmer organizations might by a concerted effort get under the control of influences that are exactly detrimental to the farmer. For instance, if there is such a thing as it is claimed there is, the Fertilizer Trust, suppose the Fertilizer Trust, at the expenditure, perhaps, of a large amount of money, would work some manipulation by which they would get control of this organization, or get control of the men who represented these organizations, and in that way they would not only nullify what we intend to do here by this kind of a provision, but they would make it just exactly the opposite to what we are trying to accomplish.

Senator HARRISON. This provision, however, says that the President shall nominate for membership on the board not more than seven of these candidates, and they shall be confirmed by the Senate.

Mr. MAYO. Yes, sir. I think that safeguards it very well. If there is any suspicion or charge against any one of the organizations, you can cover it by that.

Senator HARRISON. I should not think there would be any trouble about getting together on a proposition like that.

The CHAIRMAN. I think we are all trying to accomplish the same thing. I don't think there is any doubt about that. Don't you think, instead of naming the organizations——

Senator HARRISON (interposing). I think there ought to be a provision there that the Congress could change it at any time they should see fit, by a majority vote, if such a situation should arise as you name, and it is possible. Certainly, Congress ought to have a right to change that contract to that extent.

Mr. MAYO. I would like to have you hear some of these organizations, as the House committee did.

The CHAIRMAN. Yes. I think we will, before we get through, hear some of them. For instance, the organization that I mentioned awhile ago is the National Board of Farm Organizations, I think, a sort of an organization of organizations. Mr. E. A. Lyman is the secretary, and has been here several years, and I think, has the confidence, as far as I know, without question, of the farmers and the Members of Congress with whom he has come in contact. It may be that that is included there.

Mr. MAYO. I think it is. I think he has been consulted on the matter.

The CHAIRMAN. I think we can arrange that so it will be satisfactory.

Mr. MAYO. My understanding is that that paragraph has been placed in the hands of every farm organization of every nature in the country.

Senator HARRISON. They are the three outstanding farmers' organizations today.

Mr. MAYO. We thought so, and do yet think so.

The CHAIRMAN. Well, I am not questioning that.

Mr. MAYO. I know you are not, and I get your point exactly.

The CHAIRMAN. The point I make is that this contract runs so long. If it was going to be for a couple of years, we would take conditions as they are, but I have an idea in five years from now we will probably have an entirely different lot of representatives here. There may be organizations named differently entirely, and they may change again and again. They change like the complexion of Congress changes, and an organization that to-day may be representative of the farmers in 10 years from now may be really representative of the Fertilizer Trust or the Steel Trust, or something of that kind.

Mr. MAYO. Well, if it is so framed as we have it now, to include merely the three leading organizations, whoever they may be, it would meet your criticism?

The CHAIRMAN. Yes; I think so.

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Senator HARRISON. It seems that these farmer organizations may each designate not more than seven candidates for this board. They do not have to be members of these organizations, the American Farm Bureau Federation, the National Grange, or the Farmers' Education and Cooperative Union of America. They are simply named by these three organizations. They may go outside of their organization and select them, and then out of the 21 they nominate the President selects and sends to the Senate 7.

Mr. MAYO. Yes.

Near the end of paragraph 15 you will note we have struck out "the said board shall also determine the equitable territorial distribution of fertilizer products produced at nitrate plant No. 2." There was some question as to whether we had that fully explained. That is, our intentions were to deliver these fertilizers directly to the consumers' hands.. So we rewrote a new sentence which we have inserted, which makes it a little more explicit. Is there any criticism in regard to that?

Paragraph 17 refers wholly to the United States Government taking over the plant in case of an emergency.

Paragraph 18 is in reference to this 100-year lease period, and you will notice we have struck out at the latter end of the fourth line the preference that was written in, which has been changed to read, "prescribed by Congress," leaving it wholly within the power of Congress to determine what any renewal of the lease may be.

Paragraph 19 sets out the method of procedure in case any of the terms of the contract are violated. It is so written, I think, that it insures the fulfillment of the contract as a whole, or any part of it.

Paragraph 20 simply relates to the contract being accepted as a whole and not in part.

Senator MCNARY. I would like to ask a general question, if you please, Mr. Chairman, involving the money transaction.

In the Ford offer you propose to give to the Government $5,000,000 in exchange for the two nitrate plants, the two steam plants furnishing supplementary power, the Gorgas plant, the 88 miles of transmission line, the rock quarry, all of which cost the Government practically $90,000,000. Is that correct?

Mr. MAYO. That is correct, yes, sir.

The CHAIRMAN. And you ought to include in that, Senator, the working material there, the railroad and other material.

Senator MCNARY. Other physical property.

The CHAIRMAN. Yes.

Senator MCNARY. Then you want the Government to complete the construction of Wilson Dam, or Dam No. 2, at an approximate cost of $10,000,000?

Mr. MAYO. Yes.

Senator MCNARY. Then you want the Government to construct dam No. 3 at an estimated cost of from $40,000,000 to $50,000,000?

Mr. MAYO. Yes.

Senator MCNARY. Upon those two investments you return to the government 4 per cent. Is that correct?

Mr. MAYO. We return to the Government 4 per cent annually. That is the lease price on the total cost of the two dams.

Senator KENDRICK. Might I interrupt there?

The CHAIRMAN. Yes.

Senator KENDRICK. As I understand the proposition, it is 4 per cent upon the additional cost and not on the amount already invested. Is that true?

Mr. MAYO. That is correct, yes, sir.

Senator MCNARY. There is no return to the government on the $90,000,000 in the way of interest? All the compensation the Government receives is $5,000,000, and you have the property outright?

Mr. MAYO. Oh, no; they receive compensation due to keeping the plant in emergency readiness at all times.

Senator MCNARY. I am speaking of cash outlays now. You return to the Government for all this property which I first mentioned $5,000,000 and that ends that transaction so far as the money consideration is concerned?

Mr. MAYO. It costs money to keep it in readiness.

Senator MCNARY. That is a question of maintenance. I am directing my questions to the amount of money that actually would be transferred from Mr. Ford to the Government, and that is $5,000,000, is it not?

Mr. MAYO. That is $5,000,000, but we have got to spend money all the while to carry out the terms of the contract.

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Senator McNARY. I got a little confused on the first answer. I hate to repeat it again. I tried to outline the physical property that you are getting for $5,000,000, and which cost the Government $90,000,000. I think we agreed on that?

Mr. MAYO. Yes, sir.

Senator McNARY. That ends Mr. Ford's obligation for those properties, does it not?

Mr. MAYO. I don't think so.

Senator McNARY. Then, where is it? That is what I want to know. I am just asking for information myself.

Mr. MAYO. Well, he keeps the nitrate plant in emergency readiness for the whole term of 100 years—which costs a great deal of money.

Senator McNARY. Yes; but he is operating it during that time, is he not, for manufacturing purposes?

Mr. MAYO. But he is not operating all of the apparatus that he has to keep in emergency readiness.

Senator McNARY. You make the point that Mr. Ford is returning something to the Government by reason of the fact that for 100 years he is keeping nitrate plant No. 2 in readiness to make explosives in time of war?

Mr. MAYO. Yes, sir.

Senator McNARY. I consider that nil from the fact that at the same time you are manufacturing fertilizer on the contract out of which Mr. Ford makes a profit.

Mr. MAYO. Surely he makes a profit, but in making the fertilizer he does not have to keep all of the apparatus in order that he has to keep in readiness in order to make explosives in time of war.

Senator McNARY. Do you think that is a considerable element in the way of compensation to the Government?

Mr. MAYO. Depreciation on the plant as a whole has been estimated at $2,350,000 annually.

NOTE.—The estimate of the Ordnance Department on the depreciation of nitrate plant No. 2 is 5 per cent on $47,000,000, or $2,350,000 annually.

Senator McNARY. In its present form—not being used?

Mr. MAYO. Yes, sir.

Senator McNARY. Well, that perhaps is correct. Now, following that a little further, the investment that I mentioned a moment ago—the completion of Wilson Dam and the construction of Dam No. 3—that money is to be put up by the Government?

Mr. MAYO. Yes, sir.

Senator McNARY. Upon that you pay 4 per cent, don't you?

Mr. MAYO. Yes, sir.

Senator McNARY. Is there anything else returned to the Government for this vast property?

Mr. MAYO. We pay 4 per cent on the cost of the dams and the maintenance, also a sinking fund to wipe out its entire cost.

Senator McNARY. That is the entire cost of Dam No. 3?

Mr. MAYO. The entire cost of both dams; to complete the work.

Senator McNARY. That is the completion of Wilson Dam?

Mr. MAYO. Yes, sir; and also Dam No. 3.

Senator McNARY. And not the amount that has up to this time been invested by the Government?

Mr. MAYO. We are of the opinion that the amount we have named will wipe out the original cost of the work done on Dam No. 2.

Senator McNARY. That is all.

Senator KENDRICK. I wanted to ask Mr. Mayo on what principal would you deduct the amounts already invested in the dam in estimating the amount on which the Government has a return? As an illustration, you believe that the investment already made has been made with good engineering judgment and good construction, don't you?

Mr. MAYO. Yes, sir.

Senator KENDRICK. The additional amount would not be any more part of the construction than that that has already gone in, and on that ground I am curious to know why you would not include the return on that amount, or why you do not provide that the return should be on the entire investment in the dam.

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Mr. MAYO. The work that has been done was done during the war-time period and probably could have been done for about half what it did cost.

Senator KENDRICK. In any event there is no plan for return on any of it here, is there?

Mr. MAYO. We are offering 4 per cent of the cost to complete, but the sinking fund that we establish we think will wipe out all of the original cost as well.

Senator KENDRICK. Yes; but you do not plan to give the Government any return on the amount already invested, which you agree has been carefully and conservatively done, do you?

Mr. MAYO. No, sir.

Senator KENDRICK. It seems to me that that is as much an essential part of the dam as the amount we are now to use in completing it.

Mr. MAYO. That is very true.

Senator KENDRICK. Perhaps it would not be fair to charge up the full cost, because of the unusual conditions under which the construction was carried on, but it would seem unbusinesslike on the part of the Government to arrange that they should have no return on money that has been sensibly invested.

Mr. MAYO. Well, Mr. Ford thought that some part of this investment was properly chargeable to navigation.

Senator KENDRICK. That might be true.

Mr. MAYO. And of course, in estimating what he was able to pay——

Senator KENDRICK. But, Mr. Mayo, is it not quite possible to determine what part of the whole cost of the dam could be satisfactorily or consistently charged to the locks and the navigation feature?

Mr. MAYO. Engineers' estimates place it around eight and a half millions.

NOTE.—The Board of Engineers for Rivers and Harbors fixed the amount chargeable to navigation as $8,575,000 in 1913. (See R. and H. Comm. Doc. 20 63d Cong., 2d sess.)

Senator KENDRICK. Eight and a half millions when it is completed?

Mr. MAYO. Yes, sir.

Senator KENDRICK. And, Mr. Chairman, do you recall how much is invested in the dam up to this time?

The CHAIRMAN. About $17,000,000.

Senator KENDRICK. $17,000,000; yes.

Another question. I notice this concluding paragraph provides for acceptance or rejection—acceptance of the entire contract without modification. I ask for information. Does not the water-power act limit the lease of such power to a period of 50 years?

The CHAIRMAN. Yes. That is true, Senator.

Senator KENDRICK. I recall during the war what seemed to be a very far-seeing conclusion reached by Secretary Lane in which he said, as I recall his words, that he did not believe that any lease should be granted for a longer period than 50 years, for the reason that he thought that the next generation ought to have the right to pass upon these questions themselves.

The CHAIRMAN. I think all of us who opposed a longer term in the leasing bill held the same view that Secretary Lane did, namely, that no man could tell what conditions would be, and that 50 years was far enough to bind future generations that at that time there might be entirely different conditions, and the Government might want to operate them themselves, or they might want to do something else with them.

Senator KENDRICK. The way we are moving nowadays it would be difficult to say what would be best for us at the end of 10 years.

The CHAIRMAN. Yes. I think you could shorten it down to six months. Mr. Mayo, I want to get a sort of a bird's eye view of the Ford proposition so that it can be understood by those who read the record without going through all the technicalities. I want to go over your testimony now with you in order to get it briefly on the record. As I understand it, the Ford proposition really consists of two parts. Some of this property you propose to buy outright and some of it you propose to lease.

Mr. MAYO. That is correct.

The CHAIRMAN. What you propose to buy is nitrate plant No. 1, No. 2, all the land on which it is located, all the other real estate the Government owns there, railroads, the transmission plant running from there over to Gorgas?

Mr. MAYO. The Government's interest in them.

The CHAIRMAN. The Government owns the transmission line, except it does not own the land on which it is built.

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Mr. MAYO. Yes.

The CHAIRMAN. The Government constructed it all. You are going to get title to that from the Government?

Mr. MAYO. Yes, sir.

The CHAIRMAN. And leaving for the moment the Gorgas proposition out—I will more particularly refer to that later, but will leave it out now—then you propose to lease the two dams?

Mr. MAYO. Yes, sir.

The CHAIRMAN. Which you shall construct, but the Government shall pay for their construction?

Mr. MAYO. Correct.

The CHAIRMAN. You propose to pay as consideration for the property you buy $5,000,000 in installments as provided in your proposition, and you propose to pay to the Government for the dams which you will lease 4 per cent of the money that it costs to build them, commencing now?

Mr. MAYO. Yes, sir.

The CHAIRMAN. That is the cost commencing now?

Mr. MAYO. Yes.

The CHAIRMAN. And then to pay an amortization that in 100 years will wipe out the cost of the two dams?

Mr. MAYO. That is correct .

The CHAIRMAN. So that in the end of 100 years you will still have title to this property you bought?

Mr. MAYO. Yes, sir.

The CHAIRMAN. But your lease will have expired and you will have no interest in the dams excepting the contract gives you a preferential right in leasing it again. Now, that is correct, is it?

Mr. MAYO. That is correct; yes, sir.

The CHAIRMAN. Now, connected with that is the Gorgas proposition. You buy, in addition to the property that I have enumerated, the Government's interest in the Gorgas plant. You buy that outright?

Mr. MAYO. Yes, sir.

The CHAIRMAN. Now, would you not be able, as a matter of fact, if you got this thing, just as you have offered to take it, just as soon as it is turned over to you to turn right around and sell to the Alabama Power Co. your interest in the Gorgas steam plant for almost enough money to pay the Government the $5,000,000?

Mr. MAYO. I don't think so. Its original cost, as I understand it, was about $5,000,000.

The CHAIRMAN. About $5,000,000. Include with that the transmission line. Would you not say now, as an engineer, that you could sell the Government's interest in the Gorgas plant and the transmission line to it, from the Gorgas plant to Muscle Shoals, for $3,500,000? Would not that be a fair price?

Mr. MAYO. Well, I don't know the condition of it, but my impression would be that perhaps half of its original cost, or something like that.

The CHAIRMAN. That would be $2,500,000?

Mr. MAYO. Yes.

The CHAIRMAN. Then, as a matter of fact, you would be able to sell something that is not necessary at all in operating this business, as soon as you get the contract, for half of the money that you have to pay to the Government, and you would get the other property, that cost the Government between ninety and a hundred million dollars, for $2,500,000?

Mr. MAYO. You would if you figured it out on that basis, but we are not after the Gorgas plant to sell it.

The CHAIRMAN. I know; you don't want to sell it; but at the same time it seems to me that to keep out of difficulty over there and to stay out of lawsuits which will last for several years that is what you would have to do.

Senator KENDRICK. Would it not be necessary in the interest of business judgment for somebody to sell, either the Alabama Power Co. or Mr. Ford?

The CHAIRMAN. One or the other, I think, although Mr. Mayo has said yesterday that he thought they could reach an agreement by which they could operate it together and divide the output. I am not saying they will not be able to do that.

Senator KENDRICK. The only way I see they can do that would be for one of them to run that plant one day and the other the next. That is one way to solve the problem.

Mr. MAYO. Well, Senator, they are not having any trouble now, are they?

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Senator KENDRICK. They are not operating that as a competitor. They are operating now with the United States Government, and the United States Government is usually just a victim instead of a competitor.

The CHAIRMAN. I think what they are doing now is that they are leasing this from the Government and paying them $10,000 a month.

Major BURNS. No, sir.

The CHAIRMAN. Is not that right? What is it, Major?

Major BURNS. It is being operated by the Alabama Power Co., and they pay us a certain amount per kilowatt hour for every unit of energy that is made at that plant.

The CHAIRMAN. How much does it amount to?

Major BURNS. They pay 1½ mills per kilowatt hour.

The CHAIRMAN. How much in money do you get?

Major BURNS. Last year we got, in round figures, $100,000.

The CHAIRMAN. That includes the transmission line?

Major BURNS. No, sir.

The CHAIRMAN. That includes just the plant over there?

Major BURNS. That includes the steam plant at Gorgas.

The CHAIRMAN. That does not change my proposition very much, it seems to me. It is more than $10,000 we are getting for it.

Major BURNS. The reason why I spoke about the $10,000 is that we are getting $10,000 stand-by charge for the use of plant No. 2.

The CHAIRMAN. Oh, yes. I had that mixed up. I am much obliged to you.

Now, can not recall them just now, but you will remember them, probably—there are some additions and some exceptions to be taken out of this $5,000,000 are there not?

Mr. MAYO. Not that I recall.

The CHAIRMAN. Maybe I have some provision of this contract mixed up with some other contract.

Mr. MAYO. I don't think there are any.

The CHAIRMAN. Then you could, if you wanted to, without any doubt, if you got this contract, sell so much of it as the Alabama Power Co. wanted, to wit, the Government's interest in the steam-power plant at Gorgas, and the transmission line, and get the balance of this property for, in round numbers, about $2,500,000?

Mr. MAYO. Yes, sir.

The CHAIRMAN. Now, let us go to the dams again.

The dams you lease, and you pay 4 per cent interest on what it costs to complete Dam No. 2, and the cost of Dam No. 3, from now on?

Mr. MAYO. Yes, sir.

The CHAIRMAN. You do not pay any interest on what the Government has already spent?

Mr. MAYO. No, sir.

The CHAIRMAN. And the Government must furnish the money to complete the Dam No. 2 and to build Dam No. 3?

Mr. MAYO. Yes, sir.

The CHAIRMAN. While you do the work?

Mr. MAYO. Yes, sir.

The CHAIRMAN. In other words, this Dam No. 2 and Dam No. 3 are built at the expense of the Government?

Mr. MAYO. Yes, sir.

The CHAIRMAN. Where does this 4 per cent under your proposition commence to run?

Mr. MAYO. When we commence to get power.

The CHAIRMAN. For each dam?

Mr. MAYO. Yes, sir.

The CHAIRMAN. It is estimated by the Government engineers that it will take three years to build Dam No. 2?

Mr. MAYO. Yes, sir.

The CHAIRMAN. Is that about your idea?

Mr. MAYO. Approximately.

The CHAIRMAN. Can you do it in less time?

Mr. MAYO. I should think we can do it in about half that time.

The CHAIRMAN. A year and a half?

Mr. MAYO. Yes, sir.

The CHAIRMAN. In the meantime the Government is putting up the money. The Government would not get any interest between the time it put up the

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various installments it would have to put up to complete Dam No. 2 and to build Dam No. 3 and the time when the dams are ready to use?

Mr. MAYO. No, sir.

The CHAIRMAN. So the Government would have to take into consideration the fact that in the expenditure of this money, if your estimate is right, running for a year and a half, a portion it would not get any interest on at all?

Mr. MAYO. No, sir.

The CHAIRMAN. And when you started to build Dam No. 3 and the Government put up the money as you constructed it, how long would you say it would take you to build Dam No. 3?

Mr. MAYO. About three years from the time we started work on Dam No. 2.

The CHAIRMAN. From the time you commenced?

Mr. MAYO. Yes, sir.

The CHAIRMAN. Now, then, the Government, under your proposition, would get no interest on any of the cost of Dam No. 3 until the dam was completed and you were using the power?

Mr. MAYO. That is correct.

The CHAIRMAN. In other words, for three years on part of the money it would get no interest?

Mr. MAYO. Well, we had planned to take the money only as we needed it.

The CHAIRMAN. I understand. That is my proposition, that you take it just as you need it, but you would not pay the Government any interest on it until the dam is completed?

Mr. MAYO. That is right.

The CHAIRMAN. That means that there is some money that the Government would be out for three years without getting any return on it?

Mr. MAYO. That is right.

The CHAIRMAN. And that amount would increase, the amount that they would not get any returns on, until the dam is completed?

Mr. MAYO. Yes, sir.

The CHAIRMAN. So that as a matter of fact it is not correct to say that under your proposition the Government is going to get 4 per cent interest on the amount it spends in building that dam?

Mr. MAYO. Well, let us see if we don't want to charge that up against navigation.

The CHAIRMAN. We are already going to charge up against navigation the money that we have put into it already, about $17,000,000 in that one dam.

Mr. MAYO. There are several ways of looking at it. If we do not sell the nitrate plants you have to keep them in order, and you are up against the continual expense of that, which you might add as a credit against this.

The CHAIRMAN. I think so, and all I am trying to do is to get the picture correct.

Now, I want to go back to that, since you have mentioned it. Senator McNary's question called attention to that, and I think that is true. The Government would have to spend some money in keeping the plant always ready to operate, and you would have to spend some money in keeping the plant ready to operate to make munitions of war on five days' notice?

Mr. MAYO. Yes, sir.

Senator KENDRICK. I wanted to ask a question right there, if the Ford company proposes to keep these two nitrate plants, No. 1 and No. 2, in readiness for use.

The CHAIRMAN. No. They don't expect to use plant No. 1 for nitrates at all. They may make automobiles or something of that kind there.

Senator KENDRICK. Do you propose to keep the whole of plant No. 2, then, in readiness for operation?

The CHAIRMAN. Yes.

Senator KENDRICK. And only use it in the production of this compound that enters into fertilizer?

The CHAIRMAN. Yes. They are going to make nitrates. They are going to make fertilizer with it. That is just what I was leading up to, Senator, when you interrupted me.

Now, you mentioned the cost of keeping plant No. 2 in constant readiness for the manufacture of explosives. In the meantime you are going to use plant No. 2 for the manufacture of fertilizers?

Mr. MAYO. Yes, sir.

The CHAIRMAN. So it is not hardly right, is it, to say that you have got to spend a lot of money to keep Nitrate Plant No. 2 ready to make explosives

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when, as a matter of fact, you are going to utilize it yourself in making fertilizer?

Mr. MAYO. Quite a large part of it, Senator.

The CHAIRMAN. There would be some part of it. That part of the plant that you would not utilize or use in making fertilizer but which would be necessary in making explosives you would have to take care of and keep in good shape all the time?

Mr. MAYO. Yes, sir.

The CHAIRMAN. That is a minor part compared with the whole plant, is it not?

Mr. MAYO. Well, it is not so very small. I would say about 33⅓ per cent.

Senator NORBECK. Who carries the insurance on this property during this period?

Mr. MAYO. Which property do you refer to, Senator? The dams or the nitrate plants, or both?

Senator NORBECK. Yes. The only thing I have in mind is if the nitrate plants should be destroyed by fire who will have to replace it?

Mr. MAYO. Mr. Ford would have to replace it. It is his property. He would have to keep it insured to live up to the terms of the contract.

The CHAIRMAN. Senator, Mr. Ford gets absolute title in fee under his proposition to nitrate plant No. 1 and nitrate plant No. 2 and all the other property that the Government has there. He owns it exactly the same as he owns his factory in Detroit, and he makes no agreement under his proposition in regard to plant No. 1. He gets it. It is his. He can make it into a residence if he wants to, or he can do anything he pleases with it. But he does agree that nitrate plant No. 2 he will operate. I assume if it was destroyed by fire he would have to rebuild it.

Mr. MAYO. Certainly.

The CHAIRMAN. He would very likely keep it insured in the meantime.

Mr. MAYO. Yes, sir.

The CHAIRMAN. It would be just like any other property that he owns?

Mr. MAYO. Yes, sir.

The CHAIRMAN. He would have title to it just the same as he does everything else that he owns?

Mr. MAYO. Yes.

Senator HEFLIN. Except at the end of a hundred years——

The CHAIRMAN. No; he owns it. The only thing that the end of a hundred years cuts any figure in are the two dams. Is not that right, Mr. Mayo?

Mr. MAYO. That is correct.

The CHAIRMAN. He leases those, but he buys the other property. That is what this $5,000,000 is for.

Senator KENDRICK. Also his obligation as to maintenance of these plants would terminate?

The CHAIRMAN. At the end of a hundred years?

Senator KENDRICK. At the end of his lease.

The CHAIRMAN. At the end of a hundred years the Government owns the dams then as they do all the time, but the Government has paid for them, but Mr. Ford has paid the money back.

Senator MCNARY. In amortization.

The CHAIRMAN. Under the amortization plan. The contract is ended. He does not have to make any more fertilizer or explosives, and does not have to keep the plant ready, but that is his plant.

Senator HEFLIN. He buys the plant outright.

The CHAIRMAN. Let me develop that a little.

At the end of a hundred years Mr. Ford owns nitrate plant No. 2 the same as he does at the beginning?

Mr. MAYO. Yes, sir.

The CHAIRMAN. He can tear the machinery out then if he wants to?

Mr. MAYO. Yes, sir.

The CHAIRMAN. He does not need to make fertilizer; he does not need to keep it ready to manufacture explosives, so at the end of a hundred years we find ourselves in this position: The Government will own the dams clear of any lease to Mr. Ford. They will belong to the Government?

Mr. MAYO. Yes, sir.

The CHAIRMAN. Mr. Ford will own all the other property clear of any lien or obligation to the Government?

MAYO. Yes, sir.

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The CHAIRMAN. The Government has the dams, but it does not have the nitrate plants; it does not have any machinery there for the making of explosives?

Mr. MAYO. No, sir.

The CHAIRMAN. That is all over with?

Mr. MAYO. Yes, sir.

Senator NORBECK. The only obligation the Government has at the end of a hundred years is that Ford shall have the first opportunity to lease that dam?

The CHAIRMAN. That is all.

Senator MCNARY. Mr. Mayo, in connection with the making of fertilizer by the atmospheric fixation process, you retain the privilege of making 8 per cent on on investment?

Mr. MAYO. Yes, sir.

Senator MCNARY. The amount of money involved?

Mr. MAYO. Yes, sir.

Senator MCNARY. All of which is Government money, upon which you pay 4 per cent?

Mr. MAYO. No, sir.

Senator MCNARY. Where do you pay more than 4 per cent?

Mr. MAYO. You say all of it is Government money?

Senator MCNARY. All money you get outside of, as the chairman has so well illustrated by the picture he has drawn—and I don't want to go over the ground—that you get, as you say, for $5,000,000, and as he says for $2,500,000; that is, all the physical property that he mentioned?

Mr. MAYO. Yes, sir.

Senator MCNARY. But all the Government puts up for the completion of Dam No. 2 and for the building of Dam No. 3 you pay 4 per cent on?

Mr. MAYO. Yes, sir.

Senator MCNARY. So whatever investment the Government makes, you never pay more than 4 per cent?

Mr. MAYO. That is correct.

Senator MCNARY. But in the sale of fertilizer to the farmer you retain the right to make 8 per cent?

Mr. MAYO. Yes, sir.

Senator HEFLIN. You invest a great deal of your own money in the enterprise?

Mr. MAYO. Would you want to take a chance on a business enterprise at less than 8 per cent?

Senator HEFLIN. Is it not true that you are going to invest millions of your money in this industrial proposition? You are going to put up there millions of your own money in connection with the money expended by the Goverment, are you not?

Mr. MAYO. Yes, sir. That is correct.

Senator HEFLIN. You are reserving the right to make 8 per cent on the money that you invest; is not that right?

Mr. MAYO. That is right.

Senator MCNARY. I think the chairman has clearly demonstrated by the questions he has asked and the conservative figures that he used that you will have invested two and a half million dollars for all this property. I think you conceded that a moment ago, and you do now, don't you?

Mr. MAYO. No, sir.

Senator HARRISON. That is the amount the Government would be paid, but how much would you expend yourself in getting these plants?

Senator MCNARY. What sum of money in addition to $2,500,000 are you going to invest, and for what purpose?

Mr. MAYO. If we should sell the Gorgas plant we would have to replace it with some other, but we do not anticipate selling it. It is very necessary.

Senator HARRISON. Let us omit the Gorgas plant.

Mr. MAYO. It is very necessary.

The CHAIRMAN. You don't have to have the Gorgas plant. I concede it is a good property, and I would like to have it myself. It is a good property, because it makes cheap power, but you could take this proposition and eliminate Gorgas entirely. There is that big steam plant at nitrate plant No. 2 that is in perfect running order, as good as any in the world of its kind. There is the steam plant at nitrate plant No. 1, a much smaller steam plant, that is ready to start up to-morrow and operate in perfect condition, and everything modern. In nitrate plant No. 1 the thing that is not any good is the machinery that is in there to make nitrates. The buildings are in perfect condition, conceded to be,

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well built. The steam plant has nothing whatever wrong with it. It is the last word in steam plants, and you could use either one or both of those in your operations, and I think it was the intention originally of the Government to do that, if the war had lasted, and the only reason they got Gorgas was because they wanted something to furnish them power in the meantime. They wanted to utilize power for the purpose of building these great plants there. That is the reason they went into this deal with the Alabama Power Co., I suppose. I have been told that is the reason.

Mr. MAYO. Then let me ask you this: Why has the Government used Gorgas power ever since No. 2 steam plant has been finished?

The CHAIRMAN. Yes; I understand that the Gorgas power, so the engineers tell me, they can buy from the Alabama Power Co. in the amount that they want to use to work on Dam No. 3, and can buy it cheaper than they can operate the steam plant at nitrate plant No. 2, because it is so large and produces so much more power than they need there.

Mr. MAYO. Yes, sir; that is the point.

The CHAIRMAN. So it is cheaper for them to buy that power because, in the first place, it is a very cheap power considering the fact that the Government owns the transmission line.

Senator KENDRICK. The Government has an enormous investment in the power plant itself.

The CHAIRMAN. Yes. That is the reason, as I understand it, the Government operates that. I would assume if you were building there you would get your power to work on that dam where you could get it cheapest, and that would be of the Alabama Power Co., very likely, and you would continue to buy their power until you had Dam No. 2 finished. When you had Dam No. 2 finished you would have cheaper power than the Alabama Power Co. You would have the water power then.

Mr. MAYO. Yes, sir.

The CHAIRMAN. Would not this be a reasonable proposition, that while it is very desirable that you have the use of that transmission line and the Government interest until you completed Dam No. 2, you could easily arrange with the Alabama Power Co. so that they could get out of this difficulty and you could get out of it, by some understanding by which you would be able to have and use that until you finished Dam No. 3, and then sell it to them, when you would not have so much use for it?

Mr. MAYO. That is all possible, Senator, but you overlook a few facts. The steam plant at nitrate plant No. 1 is a direct-current plant. It is of no use in distributing current to any distance.

The CHAIRMAN. That is at No. 1?

Mr. MAYO. That is at No. 1.

The CHAIRMAN. That is the steam plant?

Mr. MAYO. Yes, sir. And it is only 5,000 horsepower as well, so you must almost entirely eliminate that from the power proposition. Anything that we might do at nitrate plant No. 1, we might get power from that plant for that purpose, but it is only 5,000 horsepower.

The CHAIRMAN. In other words, as I understand it, it would not be practical to use that 5,000-horsepower steam plant at nitrate plant No. 1; you would probably tear out this old machinery and put in some manufacturing establishment, and then you would use that steam plant that is right there with it?

Mr. MAYO. We may or may not. We can not tell how well it will work in.

Senator NORBECK. May I ask another question? With the development of dam No. 3 will you not need more steam power than the present power plant at No. 2?

Mr. MAYO. Yes, sir.

The CHAIRMAN. Now, let me interrupt there. He would not need more steam power, Senator, for any governmental operation, but, of course, you can build manufacturing establishments and keep on and build enough of them so you would have use for more power than all of this put together, I suppose.

Senator NORBECK. But the idea is that your primary horsepower would be low unless you can supplement it with steam power.

The CHAIRMAN. You would have steam power enough there to supplement the primary power?

Senator NORBECK. That No. 2, then, is enough for both dams, is it not?

Mr. MAYO. The point is that as your primary power increases you must have the supplementary steam power; your supplementary steam power must increase in the same ratio.

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Senator NORBECK. You mean with the additional power that you will get from these dams, in order to get economical operation, you would need additional power to what the present steam plant will furnish. Is that it?

Mr. MAYO. Yes, sir.

Then in regard to the steam plant at nitrate plant No. 2, the minute you strike a low-water period you dislike to start up an 80,000-horsepower unit. It is too large. If you had something about half the size it would make the plant much more flexible and you would start up the small unit first, and when the water got down lower and you needed to add to the capacity of the dams a little more, then you would start up the larger one and shut down the smaller one, and go up to its capacity, and then finally throw in the small one again.

The CHAIRMAN. In speaking of that, Mr. Mayo, there are several units in plant No. 2, and one that is not yet installed. Is not that true?

Mr. MAYO. There is only one unit in steam plant No. 2. It is subdivided into three parts.

The CHAIRMAN. You could run one of those parts without the other two?

Mr. MAYO. You can, but it is not economical to do it.

The CHAIRMAN. Could you not put in another one there? There is still room there?

Mr. MAYO. Yes, sir; that is the point I am arriving at.

The CHAIRMAN. You could put that in and operate it by itself, could you not?

Mr. MAYO. Yes, sir. And that is the logical thing to do if we do not have the Gorgas plant, and in that case we would put it in right away.

The CHAIRMAN. Yes. As I understand it now, nitrate plant No. 2, while they have about 80,000 horsepower steam there——

Mr. MAYO. Yes, sir.

The CHAIRMAN. The building and everything else is constructed with an idea of putting in another unit of 30,000?

Mr. MAYO. That is correct.

The CHAIRMAN. And the place is there. All you have to do is to put in the machinery?

Mr. MAYO. Yes, sir.

The CHAIRMAN. Everything else is there?

Mr. MAYO. Yes, sir.

The CHAIRMAN. Would it not be the economical thing to do to put that in, and if you did not want to operate your 80,000 horsepower, you could operate your 30,000?

Mr. MAYO. Yes. That is, if you didn't have Gorgas. You would operate Gorgas in preference to it, because it is cheaper power.

The CHAIRMAN. The reason it is cheaper is on account of the fuel. It is not more modern in any respect?

Mr. MAYO. No, sir.

The CHAIRMAN. But it is located at the mouth of the mine.

Mr. MAYO. But it is located at the mouth of the mine; yes, sir.

The CHAIRMAN. Which is cheaper? It is cheaper to transport the power in the shape of electricity over the transmission line than it is to haul the coal?

Mr. MAYO. That is correct; and when your No. 3 dam is finished, then your No. 2 steam plant, with both units in and Gorgas added, you are still deficient in auxiliary power.

The CHAIRMAN. Yes. Now, is it not probable, and have you not investigated enough to reach the conclusion that instead of bring coal across by rail you can easily develop coal mines upon the Tennessee River and transport it by boat on the Tennessee River after these dams are completed?

Mr. MAYO. I think we may have to. That is the probable plan.

The CHAIRMAN. So that eventually, when these dams are finished, the probabilities are that coal to supply the steam plants at plant No. 1 and plant No. 2 will be brought down the river instead of being hauled across by railroad?

Mr. MAYO. Yes, sir.

The CHAIRMAN. And when that happens, it will cheapen the cost?

Mr. MAYO. It will cheapen the cost of getting coal at nitrate plant No. 2, but it will never be as cheap as Gorgas, which is right alongside the mine. But I make the point again that with the two units in No. 2 and the Gorgas plant, when both dams are finished, you are still deficient in steam power.

Senator MCNARY. Keeping out of mind for the present the $5,000,000 which Ford pays for these vast properties, what other sums of money does he propose

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to invest at Muscle Shoals, so far as affects the interests of the Government and the public?

Mr. MAYO. It is a pretty well established fact that the cyanamid process is not an economical one. The chances are we will have to entirely rebuild that plant.

Senator MCNARY. That is, rebuild the plant or remove this machinery and put in other?

Mr. MAYO. I mean the apparatus, not particularly the buildings. There may be some changes in the buildings.

Senator MCNARY. That is problematical. You are not certain of that?

Mr. MAYO. It is certain that the cyanamid process is one of the most expensives processes to get nitrates.

Senator MCNARY. What sum of money do you calculate will make that change in the process for fixing atmospheric nitrogen?

Mr. MAYO. The changes may run perhaps $15,000,000.

Senator MCNARY. Have you made any estimate on this line so that you can make an accurate statement?

Mr. MAYO. There is nothing accurate about it; no, sir.

Senator MCNARY. So the other sum of money to be expended by Mr. Ford would be in changing the process for the making or fixation of atmospheric nitrogen?

Mr. MAYO. Yes, sir.

Senator MCNARY. Can you charge that all up to the Government? Would not some benefit inure to him by making fertilizer? Is that all invested in behalf of the Government? Is not that all investment that he makes from a business standpoint?

Mr. MAYO. That is one of them. He will make a profit out of the other materials, of course.

Senator MCNARY. Then it is not fair to say that he needs all of this property for a small amount of money because he is lending a public service?

Mr. MAYO. It depends on what you define as a public service.

Senator MCNARY. I define as a public service the fixation of atmospheric nitrogen to be sold at fair and reasonable prices to users of fertilizers.

Mr. MAYO. All right. Then the less you pay for the plant the less the amount the farmer will have to pay for his fertilizer, because all you charge against it in your cost is your capital cost, whatever it may be.

Senator MCNARY. And you would make no capital charge against the nitrate plants, because you get them for practically nothing?

Mr. MAYO. We get them for whatever they cost.

Senator MCNARY. You know what they cost. Why quibble about it?

Mr. MAYO. I am not quibbling. I am trying to keep you straight.

Senator MCNARY. We know what it cost—$5,000,000.

Mr. MAYO. All right.

Senator MCNARY. We know the original investment was $90,000,000, and you are offering $5,000,000.

Mr. MAYO. The point I make is that the farmer only pays interest on the capital cost, whatever it is.

Senator MCNARY. Oh, yes. If the Government would give you the plant and subsidize it, you can make fertilizer for nothing. That is not the point I am trying to develop.

Senator KENDRICK. Mr. Mayo, I want to ask you, Is it not true that the obligation to manufacture nitrates is dependent upon your ability to do it at a profit of 8 per cent on the investment?

Mr. MAYO. No, sir.

Senator KENDRICK. So that you could make a profit of 8 per cent?

Mr. MAYO. Not necessarily.

Senator KENDRICK. Now, is it not your belief, not a probable thing, but is it not your conviction that within a very short time we shall come to a time when cheaper money will enable us to operate almost any kind of a business at a lower rate of income?

Mr. MAYO. I think so. Of course, that will always fluctuate.

Senator KENDRICK. And, as Senator McNary has pointed out, in view of the fact that the Government has invested such a large share of this money in the original plant, do you not believe that your company could easily afford to content themselves, or get along with a profit equivalent to the amount that they pay the Government for money, say, 4 per cent?

Mr. MAYO. No, sir. The prime reason for getting the money at 4 per cent is to keep your cost as low as possible. Eight per cent we consider a very small

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profit manufacturing, considering the risk, because you may go years and make nothing.

The CHAIRMAN. Yes; I understand; but if you did that you would only be in the same class for that length of time with the farmers of the country who go year after year without making anything.

Mr. MAYO. Yes, sir.

Senator KENDRICK. And they are the people we are trying to reach with the manufacture of these fertilizers.

Mr. MAYO. Mr. Ford is starting in this business as anybody would start in any business, taking the usual business risks, and he limits himself to a profit of 8 per cent.

Senator KENDRICK. Well, I could understand the merits of that position if Mr. Ford were making the original investment. But, as it happens in this case, as I see it, you could easily charge up to the power plants your transmission lines and those things, all of the cost and whatever is now invested in those cyanamid plants that is usable would be that much, without any capital cost—would be operated without any capital cost. I ask in that connection, Mr. Chairman, what did that steam plant cost that is located near Dam No. 2?

The CHAIRMAN. Which one, Senator?

Senator KENDRICK. The large steam plant.

The CHAIRMAN. Major Burns says $12,000,000.

Senator KENDRICK. I just want to ask one more question.

Mr. Mayo, don't you believe that that plant, as it stands to-day, taken in connection with the dam as it will stand when the dam is completed, would be worth $5,000,000?

Mr. MAYO. Well, that all depends on what you can do with it.

Senator KENDRICK. Well, used in connection with the dam as increasing the amount of primary power that you would receive from the dam by reinforcing it.

Mr. MAYO. You must, of course, build your business up to absorb your power. You might view this project from the angle that it takes considerable nerve to go to this more or less virgin country and invest the large amount of money necessary to economically absorb all the power that can be developed at these two dams. When the dams are completed and the power developed, interest payments begin and it necessarily follows that you have to build large industrial plants to absorb the power, which will probably mean an investment of approximately $50,000,000, and the accepting of a huge manufacturing risk.

Senator KENDRICK. Taking it from that standpoint, I will ask you another question about it.

Is it not your opinion that if the Government proceeds to complete the dam, allowed its investments to stand as they are, within 30 days after the dam was completed, whether it was one or two dams—we will say No. 2 to begin with—if that dam were completed, at the end of three years' time the Government could within 30 days secure a return on that investment that would take care of this 4 per cent return?

Mr. MAYO. I don't think they could.

Senator KENDRICK. Right in that neighborhood?

Mr. MAYO. No, sir.

Senator KENDRICK. In my opinion they could. They are paying higher prices for steam power all over the country for manufacturing plants than the Government would find it necessary to charge for water power; otherwise the water power would be a failure.

Mr. MAYO. Well, of course, that dam will furnish primary power of about 100,000 horsepower, and a maximum of about 600,000, and there is nothing that I know of in that section of the country that would absorb anywhere near that amount of power.

Senator KENDRICK. Not within a hundred miles?

Mr. MAYO. No, sir. And, of course, even though you could absorb the primary, then there is all the secondary that goes to waste.

The CHAIRMAN. Senator, you must not confine your distance to a hundred miles. Put that 300 miles—a radius of 300 miles.

Senator KENDRICK. I suppose that would reach Chattanooga.

The CHAIRMAN. Three hundred miles would reach New Orleans.

Senator KENDRICK. Yes; I understand, by building these transmission lines there is no question about it, but there is so much opportunity to employ power within a radius of a short distance there that it ought to take care of this income charge, this interest charge of 4 per cent.

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Senator HEFLIN. I was going to ask you, Mr. Mayo—Senator Kendrick asked you a question about the amount of money already invested by the Government at Muscle Shoals, and then suggested the smaller amount that you might pay in connection with your desire to make 8 per cent on the investment. It is your plan to make 8 per cent on the cost of production of fertilizer?

Mr. MAYO. Yes, sir.

Senator HEFLIN. So, if you get the Government's equipment given to you you could produce fertilizer at a smaller cost to the farmers?

Mr. MAYO. Yes, sir.

Senator NORBECK. I am not sure that I understand what will be considered the capital cost in this deal. You start out with an investment of $5,000,000, but it covers additional property besides the property you intend to use for fertilizer?

Mr. MAYO. Yes, sir.

Senator NORBECK. Might it not be argued that you are paying for the other property and you get this for nothing, and therefore there should be no capital charge against this part of the property?

Senator KENDRICK. That is the question I asked a moment ago, exactly.

Mr. MAYO. I did not so understand you.

Senator KENDRICK. My idea was you could charge up the other properties to the $5,000,000 until it had been entirely absorbed, and that this cyanamid plant might stand, if you chose to figure it in that way, or it might represent or might come to you for nothing, at no cost. Now, in that event my contention was that you could afford to manufacture fertilizers there on the basis of income or return the same as you use the Government's money, 4 per cent.

Mr. MAYO. Well, it is not a question of what you——

Senator KENDRICK. In this proposition you limit your responsibility of operation to 8 per cent, don't you?

Mr. MAYO. Yes, sir.

Senator KENDRICK. You must have that. It is my contention that if you had this plant for nothing you might be willing to reduce that limitation to 4 per cent profit.

Mr. MAYO. Well, I don't think it would be a good business risk. Eight per cent is your maximum profit. As I said before, you might have to run at times with nothing, or even at a loss. Every manufacturing business is so operated that at times they make up, say, 20 per cent, or something of that kind.

The CHAIRMAN. Of course, under your proposition here you could not do that?

Mr. MAYO. No, sir. Our maximum is 8 per cent. It seemed to us that that was the lowest safe margin.

Senator KENDRICK. Then does this 8 per cent rate mean an average rate of 8 per cent, and if so, over what period of time?

Mr. MAYO. Eight per cent annually, we say.

Senator KENDRICK. Eight per cent annually?

Mr. MAYO. Yes.

The CHAIRMAN. Of course, there might be, Mr. Mayo, a chance for a difference of opinion as to what you should use as the basis for computing your 8 per cent.

Mr. MAYO. Exactly, and we have so written in the offer that this board sits in on our books and costs.

The CHAIRMAN. Yes. For instance, you pay $5,000,000 for property, some of which is properly chargeable to fertilizer, but it is quite evident that not all of it is.

Mr. MAYO. Surely not.

The CHAIRMAN. You buy a good deal of other property?

Mr. MAYO. Yes.

The CHAIRMAN. And it might be a subject of great controversy as to just how much of that should be charged up to capital cost of the fertilizer business.

Mr. MAYO. Exactly, and it has always been our intention——

Senator KENDRICK. That is not made clear in the contract, is it?

The CHAIRMAN. The contract, as I understand it, recognizes that difficulty, and——

Mr. MAYO. Yes, sir.

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The CHAIRMAN. And sets up a method to ascertain what is right.

Mr. MAYO. And the intention has always been to subdivide it so that only that part of the plant that makes fertilizer shall be included in the capital cost.

The CHAIRMAN. That is the reason, Senator Kendrick, I think, that the naming of these farm organizations in the contract becomes a very important proposition. If they should become controlled by some trust, where their interests would be against the farmer, it would be to their interest to make fertilizer cost as much as possible, whereas what we are trying to do is to get it as cheaply as possible.

Mr. MAYO. Yes, sir.

Senator KENDRICK. I think I agree with you completely, Mr. Chairman, but it does seem to me to be important that a contract extending over a long period of time might be made flexible as to the limitation of earnings. You have an arbitrarily fixed rate of earnings of 8 per cent. Before we are through with this thing all credits—and I mean sound credits—we are going to make the satisfactory income on an ordinary business a very much lower rate than we have it now.

The CHAIRMAN. Your theory, Senator, as I understand it, is that while 8 per cent might be right now, in 50 years it might not be right.

Senator KENDRICK. It might be entirely in error, Mr. Chairman, in 10 years.

The CHAIRMAN. Yes; it might.

Mr. MAYO. Do I understand you to say that you think it may be entirely too large?

Senator KENDRICK. Quite so, to make it a prohibitive thing, as you have here. It would be entirely optional with you, as I understand your contract, as to whether you manufactured any fertilizer or not in case you are unable to make a profit of 8 per cent. Now, the conditions might be such within five years' time—and I believe they will——

The CHAIRMAN. Is that your understanding, Mr. Mayo?

Mr. MAYO. No.

The CHAIRMAN. I did not get it that way.

Mr. MAYO. I was waiting until he finished.

The CHAIRMAN. I think, Senator, you are wrong about that.

Senator KENDRICK. Is it not written in your contract unless you can make 8 per cent——

Mr. MAYO. No; it is not.

The CHAIRMAN. I thought a while ago that there was a misunderstanding between you. You didn't understand his question.

Senator KENDRICK. Suppose you could not make 8 per cent. Suppose you could not make any profit, but had to go on manufacturing at cost. Is there any provision there that would compel you to proceed?

Mr. MAYO. That is entirely covered. I made the statement when I was asked if Mr. Ford would run at a loss that if he operated at a loss after exhausting every possible effort and using every modern device that he could to make it at a profit, if he still was operating at a loss and continued to do so, I thought he could come to Congress and get relief on the contract. But the way this contract is written there is no allowance for that at all.

The CHAIRMAN. My understanding of this proposition is that under this offer Mr. Ford would have to make fertilizer whether he made a profit or whether he did it at a loss, but that he could not make more than 8 per cent. Is that your understanding?

Mr. MAYO. That is correct; yes, sir.

Senator KENDRICK. Would he have to continue to make a fixed amount without regard to profit?

The CHAIRMAN. To the capacity of this plant.

Mr. MAYO. The amount stated here is the minimum amount, too.

The CHAIRMAN. One hundred and ten thousand tons of ammonium nitrate annually?

Mr. MAYO. Yes, sir.

Senator KENDRICK. Well, that is quite a different phase.

Mr. MAYO. I am confident, and I think Mr. Ford is, that if the time ever came that he had exhausted every effort and could not make fertilizer as cheaply as it was being made elsewhere, for some unknown reason—that is, unknown to-day—he could come here and get relief from Congress.

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Senator KENDRICK. I see no objection whatever to allowing him as much as 8 per cent profit at this time, but I do believe that the time is coming——

The CHAIRMAN. That runs through every provision of this contract and all the others, because we have got such a long time involved. We don't know even in 50 years that conditions may not be so different that the contracts may not be applicable to conditions at all. That is one of the risks we run in leasing now for a long term of years; and in this case, Mr. Mayo, it does seem to me we are making a lease here for 100 years and selling you a plant that you will absolutely own without any obligation to the Government whatever at the end of 100 years; and will future generations not be able to say to a Congress that does that, that by our act now we have robbed them of their just inheritance, as a war proposition, to always have this thing ready for war?

Mr. MAYO. That was argued before the House committee, and that was the reason for cutting out the latter part of paragraph 18. They argued that we were tying up their children's children, and their children, and so on, in making the Government insure us power after 100 years.

The CHAIRMAN. We will have to quit now until 10.30 to-morrow morning.

(Whereupon, at 12 o'clock noon, the hearing was adjourned to 10.30 o'clock a. m., Wednesday, May 3, 1922.)

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MUSCLE SHOALS.

WEDNESDAY, MAY 3, 1922.

UNITED STATES SENATE,
COMMITTEE ON AGRICULTURE AND FORESTRY,
Washington, D. C.

The committee met, pursuant to adjournment, at 10.30 o'clock a. m., in room 224, Senate Office Building, Senator George W. Norris presiding.

Present: Senators Norris (chairman), Norbeck, and Heflin.

STATEMENT OF MR. WILLIAM B. MAYO—Resumed.

The CHAIRMAN. You may proceed, Mr. Mayo.

Mr. MAYO. When we closed yesterday, Mr. Chairman, you were discussing the terms of the lease, if you will remember.

The CHAIRMAN. Yes.

Mr. MAYO. And you made the point that at the termination of the lease period the Government would not be protected from a military preparedness point of view. I am of the opinion that is not so, because the terms for a new lease are fully within the control of Congress. They can lay down any rule in making a new lease with us.

The CHAIRMAN. Of course, in case of war we could take possession of the plant, no matter who owns it.

Mr. MAYO. Yes, sir.

The CHAIRMAN. The point I wanted to call attention to, Mr. Mayo, is that if we had that we would not have to buy it or pay big damages for it. We already own it now, and the question is whether we ought not to keep it, so we would not have to pay damages in case we wanted to use it for war purposes.

Mr. MAYO. Under the terms of the lease you are protected.

The CHAIRMAN. Yes; we are protected under the terms of the lease.

Mr. MAYO. It is in the hands of Congress to make a new lease on any terms they choose. They can just as well protect themselves in the new lease as they have in this one.

The CHAIRMAN. They could, of course, or they could take it over absolutely and condemn it.

Mr. MAYO. Yes, sir.

The CHAIRMAN. But in either case they are taking somebody else's property and the property would be just the same as mine or anybody else's who never had any deal with the Government at all; if they took it they would have to pay a lot of money to get it. In other words, they have the property now, and don't have to take it, and the Government always losses lots of money, both when it buys and when it sells. That is the only point in it. They could take it, of course.

Mr. MAYO. It seems to me that under the terms of the present lease it would cost them less for this protection than it would if they retained ownership, because if they retained ownership they would have to operate all the while in order to keep down the expense, or be subject to a stand-by expense, holding it in readiness for a time of emergency. Under the terms of this lease they are not only protected in all the ways that they would be protected if they owned the property themselves, but it would be less expensive, and the plant would be fully organized and kept right up with the state of the art in making explosives and improved as time went on. So it seems to me that the Government would be in a much better condition and, as far as I can see, the same

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reasoning would apply to a new lease, because Congress could lay down the same rules in a new lease that they have in this one. Is not that logical?

The CHAIRMAN. Oh, yes; it could be done under any terms they pleased in a new lease, but still they would be dealing, in your case, with your corporation that owned the property in fee, clear of any lien of any kind that the Government had, at the expiration of this lease. It would be just the same as though you had started in without any connection with the Government and the Government got into war and took your property. It could not compel you to lease it again. You would not have to re-lease it if you did not want to. It would be making an entirely new contract. The Government, it is true, could refuse to lease it from you without it was protected. That is all true, but the Government would have to pay for it.

Mr. MAYO. Yes, sir. While that contention is true, yet in order to operate the plant it would be necessary to have the power, and we would have to buy the power from the Government. So in a way the Government is linked up with the plant and indispensable to it.

The CHAIRMAN. Of course, at the expiration you would own all this property free of any lien whatsoever on the part of the Government, and the Government would own the two dams free of any claims from you?

Mr. MAYO. Yes; and one is entirely dependent on the other.

The CHAIRMAN. Yes; they might be. Of course, in 100 years from now it may be that you would have all the power you wanted without using the dam.

Senator NORBECK. Maybe wars will be out of style, too, Mr. Chairman, and we would not need this plant.

The CHAIRMAN. I hope that will be true, but I hate to bind future generations on that score. War may be more popular in 100 years from now than it is now. They may have forgotten these things and be ready to start in anew on another world controversy. I hate to tie up unborn generations so that they will be in the same hold we were in at the beginning of this war. It would have been a great thing for the Government of the United States if at the beginning of this war they had what they have down there now.

Mr. MAYO. Yes, sir.

The CHAIRMAN. It would have been a wonderful thing. It is almost impossible to estimate, without drawing on the imagination, just what that would have meant in this war, because I understand the Allies were right to the verge on munitions. They didn't have a 30 days' supply, and 30 days continuous war would have taken everything they had and left them without ammunition. It was really that desperate condition that induced the Government to go into this. I am told, too, that one of the reasons the expenses are so great is that they worked 24 hours a day at times, three shifts, in order to hurry it and get it ready.

Mr. MAYO. This point was brought up yesterday, and in thinking it over it seemed to me that the Government was in every way better protected with this sort of arrangement than it would be if they kept ownership of the property. And, reasoning along those lines, it seemed to me that inasmuch as the terms of the new lease are entirely in the hands of Congress they could decide what they should be. The industrial plant is surely dependent on the power. We could not, as we see it now, make that amount of power cheaply anywhere else in that district—not as cheaply, anyway.

The CHAIRMAN. Well, if our dream is carried out and the entire Tennessee River is developed, as it ought to be if it can be, and we build reservoirs and convert all this power into primary power, and in additional some more power dams——

Mr. MAYO (interposing). Yes, sir.

The CHAIRMAN (continuing). There will be other sources of power besides these two dams on the Tennessee River that will in volume be greater than what will be developed on these two dams.

Senator NORBECK. But, Mr. Chairman, won't nearly all of them be Government-owned dams at that?

The CHAIRMAN. Well, so far the Government has not made any move except as to these dams.

Senator NORBECK. But, under the water-power bill, won't the Government acquire it anyway?

The CHAIRMAN. If the bill I have introduced becomes a law the Government will build some more dams there, but they may be built by private parties under the general water power act.

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Senator NORBECK. And then they become Government property anyway, don't they?

The CHAIRMAN. The Government has a right to take them over at the end of the lease, 50 years. They are not owned by the Government, though, under that general dam act.

Mr. MAYO. Subject to recapture at the end of the lease.

The CHAIRMAN. At the end of the lease the Government has a right to buy them by paying for them under the terms that are laid down.

Mr. MAYO. And the condition of this contract is that the dams become Government property at the termination of the lease, without payment on the part of the Government.

The CHAIRMAN. Yes.

Mr. MAYO. Now, in regard to Senator McNary's objection, or seeming objection or supposition that we are going to get this plant at very low cost, providing we took over the Gorgas plant with the possibility of selling it at $2,500,000, leaving a net investment of only $2,500,000, as I stated yesterday, we have to continually keep the explosive end of this plant in order for emergency. It has been stated, I believe by Major Burns, that the maintenance and depreciation of this plant will amount to about two and a half millions a year. That is right?

Mr. WALDO. Five per cent on $47,000,000.

Major BURNS. I don't recall making that statement myself. I may have done it. When we start in figuring what is the yearly expense of that plant, or what it is going to be, you are in a very doubtful realm. It is almost impossible to foresee what it is going to be. Right to-day we are keeping the plant for an approximate cost of $100,000 a year. We don't know, though, what our real depreciation on machinery is. That is our out-of-pocket expense. In a few years a lot of that machinery may be so badly deteriorated that it will have to be replaced.

Mr. WALDO. That statement, major, had reference to a letter Mr. Fields had over in the House committee hearings referring to the depreciation on nitrate plant No. 2, taken at 5 per cent on an assumed normal peace-time valuation of $47,000,000, amounting to $2,350,000.

Major BURNS. We might have put in that answer as an effort to paint the picture. My own personal judgment is, though, that you can not charge up $2,500,000 a year as depreciation and maintenance charges for that plant. I think that is entirely too high.

Mr. WALDO. Have you made any estimate of it?

Major BURNS. As I tell you, we are spending now approximately a hundred thousand dollars a year to keep the chemical plant going. We are also receiving from the use of our steam plant in excess of $100,000 a year, probably $200,000 a year, so that our charges for keeping the plant to-day, instead of being an expense, we are making a profit on the plant. As to what your real depreciation is and as to what portion of your plant will go out and have to be replaced at the end of 5, 10, 15, 20, or 30 years, I don't know, and it is nothing but a guess as to what it will be. If you take the reproduction value of the plant at $47,000,000, assume that your depreciation is 5 per cent per year, you get the figures you mentioned.

The CHAIRMAN. But, as a matter of fact, right now, without using that plant, the Government keeping it in stand-by condition is making a profit out of it, as I understand it. It gets more for the lease of the steam power there than it costs to keep the other in stand-by condition.

Mr. MAYO. I think not, Mr. Chairman.

Major BURNS. That is correct.

Mr. MAYO. How do you assume that?

Major BURNS. We are spending down there to-day at No. 2 plant approximately a hundred thousand dollars a year. We have our steam plant leased on a fixed rental of $10,000 per month, and we are going to get in addition to that 2 mills for each kilowatt hour that is generated. To start with, your fixed rental is more than your out-of-pocket expense, and then, over and above that, we are going to get a return for each kilowatt hour of energy that is delivered. That is all excluding, of course, this percentage of depreciation on your plant.

Mr. MAYO. That is the point. It is the largest item.

The CHAIRMAN. It is all right, Mr. Mayo, for you to give any figures you want here, or take any view of it you want to. You may be right and others wrong.

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Mr. MAYO. I am trying to be fair by taking the figures of some others who have been intimately connected with the plant; but the facts are that the plant costs—what was it? Ninety million.

Mr. WALDO. Sixty-seven million.

The CHAIRMAN. You mean plant No. 2?

Mr. MAYO. Yes.

The CHAIRMAN. Sixty-seven million.

Mr. MAYO. Sixty-seven million.

The CHAIRMAN. Estimated to be worth forty-seven million, as I understand it.

Mr. MAYO. Take it at forty-seven million or, say, fifty million. Five per cent depreciation is a low depreciation rate on any manufacturing plant, particularly a chemical operation.

Major BURNS. Your judgment is much better than mine on an abstract question like that.

Mr. MAYO. Estimating the plant has 20 years' life, 5 per cent on fifty million would be two and a half million. But you can cut it in two—cut it in half—and call it a million and a quarter, if you please. I am merely trying to bring out what we have to keep in order and the possible expense, and also the fact that the plant in a hundred years will have to be rebuilt several times. So that it is without doubt a heavy liability.

Then I wish also to bring out the fact that the cyanamide process we consider a more or less obsolete process than other processes we have investigated. We can practically build an entirely new plant for five or six million dollars that would give us more capacity in ammonia. So the entire plant may soon be classed as a liability instead of an asset.

Mr. Ford in making up this offer was confronted with the fact that he was invited by the Government to make the offer, and he went down and inspected the plant and found that it was built for explosives during the war and for fertilizers during peace time.

(A short recess was here taken to enable the members to answer roll call.)

Mr. MAYO. As I started to say, Mr. Ford in framing up this offer tried to so make it that it covered all the original intentions of the Government to keep it in proper order as a national emergency protection; also to do what the Government had planned in having the plant there in peace times so as to make fertilizer at the lowest possible cost.

Senator HEFLIN. Mr. Mayo, you set out in your contract, I believe, that you are going to use about 100,000 horsepower in making fertilizer?

Mr. MAYO. That is what we figure it will take; yes, sir.

Senator HEFLIN. But I understand Mr. Ford really intends to use more than that.

Mr. MAYO. That is his intention; yes.

Senator HEFLIN. And he expects to manufacture fertilizer on a large scale?

Mr. MAYO. Yes, sir.

Senator HEFLIN. I just wanted to ask those few questions, Mr. Chairman.

Mr. MAYO. In addition to that his object was to so make his offer that it included the two dams which would improve the river navigation for a hundred miles and at the same time develop a large source of power, and to build a large industrial operation that would make the entire project a successful one.

The CHAIRMAN. His idea, as I understand you, is to establish manufacturing plants there of various kinds sufficient to utilize all the power that is not used in the Government's nitrate business?

Mr. MAYO. Yes, sir. His idea was that when he could approximately use all the power, then the question of building these storage reservoirs should be considered to increase the primary power of these dams and to increase the power up the river, which would also give large quantities of power to the different localities in which the storage dams were located. Personally I have been of the opinion that to carry out such a project Mr. Ford would have to spend approximately $50,000,000 of his own money, and I am also of the opinion that it would be of a great deal more benefit to the country at large to put all of this power into a plant of this kind, the products of which are delivered to the whole country, than it would be to divide the power up into small lots around through transmission lines for local and domestic users—local industrial plants and domestic users. Take the Ford plants at Detroit. I am of the opinion that they do the country a great deal more good with the product they produce than if the same amount of power was distributed around that local section to small industrial plants and domestic users.

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In addition to the apparatus at nitrate plant No. 2 for making fertilizer—of course, everybody understands the present apparatus only makes the nitrogen end of the product—Mr. Ford will have to install the necessary apparatus to make the phosphoric acid and potash elements of the fertilizer, so as to make a complete fertilizer. That also calls for a large investment.

The CHAIRMAN. Have you investigated on that point now, about the raw material?

Mr. MAYO. Yes, sir.

The CHAIRMAN. You can acquire it in unlimited quantities, you think, within a reasonable radius?

Mr. MAYO. Yes, sir.

The CHAIRMAN. What would you have to have, now?

Mr. MAYO. Well, the phosphoric-acid end of the business uses a large amount of phosphate rock.

The CHAIRMAN. Where would you get that?

Mr. MAYO. That is in the immediate vicinity; all the way from there to Florida.

The CHAIRMAN. Is there any other raw product that you would have to have?

Mr. MAYO. The nearest product for potash is in the Georgia shales. That is the raw material.

The CHAIRMAN. Would you be able to get the product out of that?

Mr. MAYO. Yes, sir. I am not sure that we can get all we want, but that would be one of the sources.

Senator HEFLIN. There are phosphate-rock beds, Mr. Chairman, just a few miles over in Tennessee.

The CHAIRMAN. Yes; I understand. I wanted to get it in the record. I knew about it.

Mr. MAYO. We estimate we can get all the phosphate rock we want by water transportation, delivered at the plant.

The CHAIRMAN. There is some doubt, is there not, about getting a supply of potash?

Mr. MAYO. Some; yes, sir.

The CHAIRMAN. In such condition that it is usable?

Mr. MAYO. Yes, sir.

The CHAIRMAN. It will probably be necessary, unless we discover new sources, to import that, would it not, or some of it?

Mr. MAYO. It might be.

The CHAIRMAN. Have you looked into it so as to be able to give the committee an idea whether you could import that from France or Germany cheaper than you could get it from the sources that you know of now in this country?

Mr. MAYO. It might be necessary to import some at the start, but we are of the opinion that we can make all we need in the near future.

The CHAIRMAN. You would not need any of that to make explosives, would you?

Mr. MAYO. No, sir.

The CHAIRMAN. That is only applicable to the fertilizer proposition?

Mr. MAYO. Yes, sir; now, to assist in making a cheap fertilizer, we have worked out a number of processes for the metal end of our business that more or less dovetail into the fertilizer business itself, to help reduce the cost of the fertilizer product, so that would be one way of reducing the fertilizer cost that perhaps Government operation would not have at all, if they confined themselves to the fertilizer business by itself. I can not see how the Government can start in making fertilizers themselves without perhaps making a complete fertilizer, and that would mean the addition of a large amount of apparatus that I referred to before for the phosphoric acid and the potash end of the business.

The CHAIRMAN. Yes; of course. If the Government or anybody else were going to make complete fertilizer, in addition to the nitrogen, they would have to have phosphoric acid.

Mr. MAYO. Mr. Waldo made a note that I would like to have him read.

Mr. WALDO. This has to do with the value of the plants.

The value of the plants is a combination of parts that can be usefully operated, and other parts that must be scrapped, and has been stated as $16,000,000, according to the estimate of General Williams. The difference between this sum and the $5,000,000 payable by Mr. Ford is $11,000,000, which General Williams states in his testimony before the House committee is a very moderate sum to pay for national preparedness in nitrates.

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The transaction, therefore, is not a sale of $90,000,000 worth of property for $5,000,000, but the act of taking over property worth perhaps $16,000,000 under most favorable estimates, and securing national nitrate preparedness with that property at private expense. If this had been done prior to the war, a large sum (certainly $30,000,000) would have been saved by the Government.

The CHAIRMAN. Now, Mr. Waldo, you assume there that this property of the Government is only worth $16,000,000?

Mr. WALDO. Yes, sir.

The CHAIRMAN. That includes everything except the dams, does it?

Mr. WALDO. That is the nitrate plants; yes, sir—nitrate plants and accessories.

The CHAIRMAN. Am I right in saying that that includes everything except the dams?

Mr. WALDO. Yes, sir; I think you are.

Senator HEFLIN. Land and all?

The CHAIRMAN. Everything.

Mr. WALDO. That is the estimate.

The CHAIRMAN. That includes the Government's interest in the Gorgas plant, does it not?

Mr. WALDO. Yes, sir; the Gorgas plant has been included in that estimate at $3,000,000.

The CHAIRMAN. Then, outside of the Gorgas plant all the other property that the Government owns there, outside of the dams, you value at $13,000,000?

Mr. WALDO. It is not our valuation, Senator, that is General Williams's valuation.

The CHAIRMAN. What is your valuation?

Mr. WALDO. We are simply taking General Williams's statement.

The CHAIRMAN. I know that you are quoting him, and you might quote somebody that said it was not worth anything. But you represent Mr. Ford, and I want to know what his valuation is. What do you say it is?

Mr. MAYO. In reply to that I would say that it is hard to make a definite statement. As we see it, this fertilizer business, when you try to make highly concentrated fertilizers is a good deal in the same condition as the automobile business was 15 or 20 years ago. You have got to go step by step and tear down and rebuild, so it is pretty hard to say what that plant is worth for making fertilizers.

The CHAIRMAN. Yes; I admit that. I think it is a very difficult thing, and men of competent judgment will disagree, but you have put in the record Mr. Waldo's statement there.

Mr. MAYO. That was a statement by General Williams, and I thought it was proper to bring it out.

The CHAIRMAN. It is perfectly proper to put it in, but in connection with it I want to get your idea whether it is right or not.

Mr. MAYO. My reply would be it is very difficult to say.

The CHAIRMAN. Now, don't you believe it is worth more than that, Mr. Mayo?

Mr. MAYO. Well, I could not truthfully answer because, as I have stated earlier to-day, it may be that this entire nitrate end, except possibly the liquid-air plant, might be a total liability.

The CHAIRMAN. Yes; I know, and you might have an earthquake there to wipe it all out, but I would like to get your judgment now. You have one, and so has Mr. Ford. You have been investigating this property. Now, you have yourself put in the record as testimony the estimate of somebody else as to its value. Now, I want to get yours.

Mr. MAYO. The reason that prompted me to put General Williams's statement in was the question by Senator Norris yesterday trying to bring out the fact that we were——

The CHAIRMAN (interposing). I am not objecting to that. It is perfectly proper to put in anybody's estimate that you want to, but you are the fellows that are trying to lease or buy this property. Now, I want to know what you think it is worth.

Mr. MAYO. The best answer I could make is that it is worth what we offer for it.

The CHAIRMAN. Then you don't think it is worth as much as he does, do you?

Mr. MAYO. No, sir.

The CHAIRMAN. You think it is worth $5,000,000?

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Mr. MAYO. It all depends on what productive use it can be put to. When Mr. Ford made the offer we thought we had a fair idea. The more we investigate and get into the details the more mixed up we get on its value.

The CHAIRMAN. I know that, but still you are going into something that you proposed to pay $5,000,000 for to begin with, and you say you are going to invest fifty million more, and you ought to be able to give the committee what you think this property is worth that you are buying from the Government. Mr. Ford has an idea of its worth, does he not? You would not buy something you did not have any idea what it was worth?

Mr. MAYO. No, sir; we would not buy something we did not have any idea as to what it was worth.

The CHAIRMAN. I don't expect you to bring it down to a dollar or a penny——

Mr. MAYO. Well, I couldn't if I wished to.

The CHAIRMAN (continuing). But give us your best estimate of what it is worth.

Mr. MAYO. I would say that Mr. Williams's estimate there is a very liberal one. That is as near as I could put it.

The CHAIRMAN. You agree with him, then, do you?

Mr. MAYO. The more we get into this subject the more convinced we are that everything down there is more obsolete and experimental than we thought it was at the start.

The CHAIRMAN. What is obsolete about this plant now? Is there anything obsolete about the steam plant? Is not that the latest thing?

Mr. MAYO. Yes, sir.

The CHAIRMAN. And the last word in all kinds of machinery that is in it?

Mr. MAYO. The steam plant is all right in every way, so far as I can see.

The CHAIRMAN. If you were going to build a cyanamid process plant to-day could you improve on this one in any respect, except you could build it cheaper, of course?

Mr. MAYO. I don't know enough about the cyanamid business to say; but the point is that we might not use the process at all.

The CHAIRMAN. I know you might not.

Mr. MAYO. Then what?

The CHAIRMAN. You expect to use it. There is not any doubt about that.

Mr. MAYO. I am not so sure, Senator. Really, I am not so sure.

The CHAIRMAN. What do you think this Waco quarry is worth out there?

Mr. MAYO. If we adopted some other process it would not be worth anything. We wouldn't use lime rock at all.

The CHAIRMAN. I know; but you are not answering my question, now, Mr. Mayo. You have an idea as to what that is worth. You say if such and such a thing would happen it would not be worth anything. If, for instance, this afternoon there should be an earthquake there and it should wipe us all out of existence it would not be worth anything. That is true; but we have got a railroad running up to it. You get that as part of it.

Mr. MAYO. Yes, sir.

The CHAIRMAN. You get a lot of engines and freight cars.

Mr. MAYO. Yes, sir.

The CHAIRMAN. What are they worth?

Mr. MAYO. Well, most of the transportation equipment there will be used in the construction work.

The CHAIRMAN. Yes; but you would have to buy it if you did not get it. You are getting this from the Government.

Mr. MAYO. Well, that is property of the Government.

The CHAIRMAN. But you get it under your bid.

Mr. MAYO. All your construction equipment that goes with the dams we do not get; no, sir.

The CHAIRMAN. You mean to say you won't use any of the Government's equipment there?

Mr. MAYO. All that construction equipment we would use in construction of the dams.

The CHAIRMAN. Exactly. But it is your property if your bid is accepted, is it not?

Mr. MAYO. No, sir. That is Government property. We use it to construct the dams with.

The CHAIRMAN. What becomes of it when the dams are constructed? This is a new idea.

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Mr. MAYO. Whatever the salvage value on it is, it will be credited to the cost of the dams.

The CHAIRMAN. Do you expect to pay the Government anything for that equipment?

Mr. MAYO. No, sir.

The CHAIRMAN. Then are you not going to get it?

Mr. MAYO. No, sir.

The CHAIRMAN. What have you done with it when you are through with it?

Mr. MAYO. I say whatever salvage value there is in it will be credited to the dams.

The CHAIRMAN. You will sell it, then, and give the Government credit for what you get?

Mr. MAYO. Yes, sir.

The CHAIRMAN. The difference between its value now and its value then you get for nothing?

Mr. MAYO. No. It reduces the cost of the dams that much.

The CHAIRMAN. I know it does, but it saves you buying it.

Mr. MAYO. If there were no construction equipment there we would have to go out and buy it, and that would be charged up to the cost of the dams.

The CHAIRMAN. Do you know anybody else that has put a value on that property down there that has put it as low as you put it?

Mr. MAYO. I don't know that I do.

The CHAIRMAN. Do you know that it has been estimated that that is worth half what it cost and that the value has been considered as $47,000,000?

Mr. MAYO. My judgment is that you might build it for half what it originally cost, but you could not say that was its value, unless you are taking it as a going concern and going on with the processes it was constructed for and you had a good market for the product.

Senator HEFLIN. Has anybody else made a bid anything like as good as the one you have made for it?

Mr. MAYO. We don't think so, Senator.

The CHAIRMAN. That would be a proper thing for these various bidders to consider, I think, to criticize the other bids. If you care to take up the bids that have been made and show the committee wherein you think they are not good, we would be glad to have you do it.

Mr. MAYO. We have no criticism of the other bids at all. We are willing to have our bid stand on its own bottom and take our own chances. I think probably when you hear Mr. Worthington he can give you a better idea about value than I can.

Senator HEFLIN. Right at this point, as I suggested yesterday, Mr. Mayo, the smaller the amount that you have to pay for this equipment down there to the Government the cheaper you can produce fertilizer, and the farmer will benefit by the fact that you do get this equipment at a low figure, will he not?

Mr. MAYO. Yes, sir.

The CHAIRMAN. If we go on that basis, then the committee ought to get you bidders into competition to see which would bid the least for it. Wouldn't that be true?

Mr. MAYO. Well, our competition is what we have offered. We have got nothing else to offer.

The CHAIRMAN. And it would be the duty of the committee to accept the bid that was the poorest?

Senator HEFLIN. I am undertaking to say, Mr. Chairman, that somebody will derive some benefit from the development of Muscle Shoals, and that Mr. Ford agrees to manufacture fertilizer and to charge only 8 per cent upon the cost of production; and if the outfit that he uses to make fertilizer costs a lower figure, he will be able to sell to the farmer at a lower figure, and therefore the farmer will benefit, and agriculture will be benefited by it.

Mr. MAYO. Mr. Ford thinks that if anybody makes a better offer than his, an offer which will do the country more good, they ought to have it, and we may get behind them and help them get it.

The CHAIRMAN. I think we all realize that we want to let everybody get the benefit of everything, whatever it may be. We don't know, any of us, just what he is going to be able to do nor exactly what the value of the properties we have there is.

Mr. MAYO. It is very hard to forecast the future, but Mr. Ford, as I said, has tried to cover the things that the plant was originally intended for, to provide explosives in time of war, to get the fertilizers just as cheap as possible.

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to improve the navigation of the river, to get the power, and further, to industrialize that section so that it will be a successful venture.

Senator HEFLIN. Mr. Chairman, there is another proposition there. The estimate placed upon this property by the Chief of Ordnance was proceeding upon the theory that somebody would buy it outright and tear it down and do what they pleased with it, but the offer Mr. Ford is making is conditioned upon the proposition that he will keep it in good order and in readiness for use by the Government, and will turn it over to the Government for the purpose of making nitrates in time of war.

The CHAIRMAN. Of course, there are people—and the committee, as I understand it, of the House, even reported, after a visitation that they made—that the Government ought to quit, and we were unable to get any continuation of the work on that dam. They think we ought to scrap everything, let it all go, lose it all. So you can get any kind of opinion you want to. To my mind that would be one of the most foolish things—

Senator HEFLIN. It certainly would.

The CHAIRMAN. That ever entered the head of a legislator or business man or anybody that had the welfare of the country at heart. If we want to make fertilizer, if we want to utilize this power—even to sell—that property down there that the Government owns is worth a great deal more money, it seems to me; much more. Either one of these power plants, if they did nothing but act as a middle man, develop power and sell it, is worth more money than that.

Senator HEFLIN. But you have no assurance from anybody else that they will manufacture fertilizer there.

The CHAIRMAN. Of course, I don't want to discuss now the difference in these bids. The other bidders would not agree to that proposition, of course, especially Mr. Engstrum, who claims to have made a specialty of the fertilizer proposition in his bid.

Mr. MAYO. There seems to have been a very marked change in values down there since Mr. Ford made his offer.

The CHAIRMAN. Well, yes. The whole country is laid out in lots, is it not?

Mr. MAYO. Yes.

Senator HEFLIN. They all realize now that it is a very fine project.

The CHAIRMAN. They are all running for office on the strength of it. They expect that New York City will be a country village compared to Muscle Shoals.

Mr. MAYO. I don't know that we have anything else to offer, Senator.

The CHAIRMAN. All right, Mr. Mayo. We are very much obliged to you.

Senator HEFLIN. Before Mr. Ford went down there and made this offer that whole country looked like a cemetery around there, didn't it?

Mr. MAYO. On my first visit it looked akin to it; yes, sir.

The CHAIRMAN. When was that?

Mr. MAYO. That was some time last June, if I remember correctly.

The CHAIRMAN. You did not see any tombstones down there, did you? A cemetery usually has them.

Senator HEFLIN. The situation was a very dull one in a business way. It was practically dead.

The CHAIRMAN. It is very dull right now.

Mr. MAYO. It approached a graveyard.

The CHAIRMAN. I don't want to belittle you for your offer. I think you did a great thing for your country, even if you do not get this proposition, by making that bid. Your bid started everybody else to thinking and investigating.

Mr. MAYO. Yes, sir.

The CHAIRMAN. You made the first bid and first investigation, and I think it was a great thing myself.

Mr. MAYO. I beg to thank you, Senator, for recognizing Mr. Ford's effort to bring this great national project to life.

(Mr. Mayo submitted the following amended proposal, which is here printed in full, as follows:)

COPY OF FINAL LEGALLY SIGNED PROPOSAL OF JANUARY 25 NOW IN THE HANDS OF CONGRESS.

PROPOSAL OF HENRY FORD FOR THE COMPLETION AND LEASING OF THE DAMS AND THE HYDROELECTRIC POWER PLANTS AT MUSCLE SHOALS AND FOR THE PURCHASE OF NITRATE PLANT NO. 1, NITRATE PLANT NO. 2, THE WACO QUARRY, AND THE GORGAS WARRIOR RIVER STEAM PLANT, ALL IN THE STATE OF ALABAMA.

Whereas the United States, through the Chief of Engineers, United States Army, invited the undersigned to submit an offer for the power to be developed at the Muscle Shoals Wilson Dam (hereinafter referred to as Dam No. 2); and

Whereas the undersigned did, under date of July 8, 1921, submit to the Chief of Engineers, an offer for the consideration of the President, the Secretary of War, and Congress, which offer proposed a lease based upon the completion of Dam No. 2, and the construction of Dam No. 3 (as designated by the United States Engineers in H. R. Doc. 1262, 64th Cong., 1st sess., and hereinafter referred to as Dam No. 3) and of their power houses, by the United States, and the payment by the undersigned of a fixed annual rental therefor, and proposed to purchase Nitrate Plant No. 1 at Sheffield, Ala., Nitrate Plant No. 2 at Muscle Shoals, Ala., Waco Quarry, near Russellville, Ala., and the Warrior Steam Plant at Gorgas, Ala., and all transmission lines connected with said plants; and

Whereas the undersigned, at the invitation of the Secretary of War, did, on January 11, 1922, submit a modification of his former proposal, based upon the construction and completion by a company to be formed by him, of all the work referred to in the offer of July 8, 1921, aforesaid, the actual cost of said work to be borne by the United States, and agreed on behalf of said company to pay 4 per cent of the total actual cost of completing said plants, structures, works, and improvements as annual rental for the lease thereof;

Now, therefore, in lieu of said offer of July 8, 1921, and in accordance with said modification of January 11, 1922, the undersigned hereby submits to the Secretary of War, and through him for appropriate action by the President and Congress, the following offer, which shall become a binding agreement upon approval of same by Congress:

1. For the purpose of carrying out the terms of this agreement, the undersigned will form a corporation (hereinafter referred to as the company), with a paid capital stock of not less than $10,000,000, to be controlled by the undersigned, which company will immediately enter into and execute all necessary or appropriate instruments of contract to effectuate this agreement.

2. The company shall complete for the United States the construction work on Dam No. 2, its locks, power house, and all necessary equipment, all in accordance with the plans and specifications prepared, or to be prepared or approved by the Chief of Engineers, United States Army, and progressively install the hydroelectric equipment in said power house adequate for generating approximately 600,000 horsepower, all the work aforesaid to be performed as speedily as possible at actual cost and without profit to the company, it being understood that the necessary lands and flowage rights, including lands for railway and terminal connections, have been or will be acquired by the United States.

3. The company will lease from the United States Dam No. 2, its power house, and all of its hydroelectric and operating appurtenances, except the locks, together with all lands and buildings owned or to be acquired by the United States connected with or adjacent to either end of the said dam, for a period of 100 years from the date when structures and equipment of a capacity of 100,000 horsepower are constructed and installed and ready for service, and will pay to the United States as annual rental therefor 4 per cent of the actual cost of acquiring lands and flowage rights, and of completing the locks, dam, and power house facilities (but not including expenditures and obligations incurred prior to approval of this proposal by Congress), payable annually at the end of each lease year, except that during and for the first six years of the lease period the rentals shall be in the following amounts and payable at the following times, to wit: Two hundred thousand dollars one year from the date when 100,000 horsepower is installed and ready for service, and thereafter $200,000 annually at the end of each year for five years.

4. The company will further pay to the United States during the period of the lease of Dam No. 2 $35,000 annually, in installments quarterly in advance, for repairs, maintenance, and operation of Dam No. 2, its gates and locks; it being understood that all necessary repairs, maintenance, and operation thereof shall be under the direction, care, and responsibility of the United States during the said 100 year lease period; and the company, at is own expense, will make all necessary renewals and repairs incident to efficient maintenance of the power house, substructures, superstructures, machinery, and appliances appurtenant to said power house, and will maintain the same in efficient operating condition.

5. At all times during the period of the lease of Dam No. 2 the company will furnish to the United States, free of charge, to be delivered at any point on the lock grounds designated by the Chief of Engineers, United States Army,

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electric power to an amount necessary for the operation of the locks, but not in excess of 200 horsepower.

6. As soon as the release of suitable construction equipment and labor forces at Dam No. 2 will permit, or at an earlier date if desired by the company, the company shall construct and complete for the United States Dam No. 3, its lock, power house, and all necessary equipment, all in accordance with plans and specifications prepared and to be prepared by the Chief of Engineers, United States Army, or by the company, at is option, and approved by the Chief of Engineers, United States Army, and progressively install the hydroelectric equipment in said power house adequate for germinating approximately two hundred and fifty thousand (250,000) horsepower, all the work aforesaid to be performed as speedily as possible at actual cost and without profit to the company, it being understood that the necessary lands, flowage rights, and rights of way shall be acquired by the United States, through an agent to be named by the company.

7. The company will lease from the United States Dam No. 3, its power house, and all of its hydroelectric and operating appurtenances, except the lock, together with all lands and buildings owned or to be acquired by the United States connected with or adjacent to either end of the said dam, for a period of 100 years from the date when structures and equipment of a capacity of 80,000 horsepower are constructed and installed and ready for service, and will pay to the United States, as annual rental therefor, 4 per cent of the actual cost of acquiring lands and flowage rights, and of constructing the lock, dam, and power house facilities, payable annually at the end of each lease year, except that during and for the first three years of the lease period the rentals shall be in the following amounts and payable at the following times, to wit: One hundred sixty thousand dollars one year from the date when 80,000 horsepower is installed and ready for service, and thereafter $160,000 annually at the end of each year for two years.

8. The company will further pay to the United States during the period of the lease of Dam No. 3 $20,000 annually, in installments, quarterly in advance, for repairs, maintenance, and operation of Dam No. 3, its gates and lock; it being understood that all necessary repairs, maintenance, and operation thereof shall be under the direction, care, and responsibility of the United States during the said 100-year period; and the company, at its own expense, will make all necessary renewals and repairs incident to the efficient maintenance of the power house, substructures, superstructures, machinery, and appliances appurtenant to said power house, and will maintain the same in efficient operating condition.

9. At all times during the period of the lease of Dam No. 3, the company will furnish to the United States, free of charge, to be delivered at any point on the lock grounds designated by the Chief of Engineers, United States Army, electric power necessary for the operation of the said lock, but not in excess of 100 horsepower..

10. For the purpose of enabling the Government to create and provide a sinking fund to retire the cost of Dam No. 3 at the end of 100 years the company will, at the beginning of the fourth year of the lease period, and semiannually thereafter for the remaining term of the lease, pay to the United States Government the sum of $3,505; and for the purpose of enabling the Government to create and provide a sinking fund to retire the cost of Dam No. 2 at the end of 100 years, the company will at the beginning of the seventh year of the lease period, and semiannually thereafter for the remaining term of the lease, pay to the United States Government the sum of $19,868.

11. The company agrees to purchase from the United States and the United States will sell the following properties, namely:

(a) All of the property constituting nitrate plant No. 2 (as officially known and designated), including lands, power plants, buildings, material, machinery, fixtures, equipment, apparatus, appurtenances, tools, and supplies, and the right, license, and privilege to use any and all of the patents, processes, methods, and designs which have been acquired and may be transferred or assigned to a purchaser of nitrate plant No. 2 by the United States, together with the sulphuric acid units now in storage on the premises.

(b) All of the property constituting nitrate plant No. 1 (as officially known and designated), including lands, power plants, buildings, material, machinery, fixtures, equipment, apparatus, appurtenances, tools, and supplies, and the right, license, and privilege to use any and all of the patents, processes, methods, and designs which have been acquired and may be transferred to a purchaser

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of nitrate plant No. 1 by the United States, but the company shall not be obligated to operate nitrate plant No. 1 as an air nitrogen fixation plant.

(*c*) All of the property constituting the Waco Quarry (as officially known and designated), including right of way and buildings, material, quarry, tracks, machinery, railroad tracks, appurtenances, tools, and supplies.

(*d*) All of the property constituting the steam power plant, now owned by the Government at Gorgas, Ala., on the Warrior River, including lands, rights of way, buildings, machinery, material, fixtures, apparatus, appurtenances, tools, and supplies, and the transmission line from the Gorgas steam plant to nitrate plant No. 2 at Muscle Shoals, and all other transmission lines belongnig to the United States and connected with any of the aforesaid Government properties.

12. The company agrees to accept and the United States to assign and transfer to the company all rights, title, interest, powers, and benefits belonging to or that may accrue to the United States or its legal agents as a party to its contract dated December 1, 1917, with the Alabama Power Co. in connection with said Gorgas plant and transmission line, and the company will assume all obligations and liabilities lawfully imposed upon the United States by said contract; but nothing in this paragraph shall be held to affect any question of the validity of any provision of said contract.

13. As the purchase price for the foregoing plants and properties to be conveyed to the company by the United States the company will pay to the United States $5,000,000 in five installments as follows: One million dollars upon the acceptance of this offer, and $1,000,000 annually thereafter until the purchase price is fully paid, with interest at the rate of 5 per cent per annum on deferred payments, with the privilege of anticipating any or all such payments, possession to be delivered upon payment of the first of said installments, and deeds of conveyance to be delivered when full payment for said property has been made.

14. This proposal contemplates and it is agreed that the purchase price for the property aforesaid shall not be diminished by reason of depreciation due to use or wear of buildings, machinery, and equipment or to the action of the elements; nor shall any claim be made for losses in or diminution of quantity of tools and supplies due to upkeep and maintenance during the period between the date hereof and the date of delivery of possession of said property, it being further understood that no inventory of the property need be taken, but that due care will be exercised by the United States in preserving and safeguarding the aforesaid real and personal property intact until possession thereof passes to the company. If any part or parts of the aforesaid plants necessary for proper operation of same have been removed by the United States, said part or parts shall be returned when possession of said plants passes to the company. Deeds of conveyance of real property shall warrant the title to be good and unencumbered.

15. The company agrees to operate nitrate plant No. 2, using the most economical source of power, at the approximate present annual capacity of its machinery and equipment, in the production of nitrogen and other commercial fertilizers (said capacity being equal to approximately 110,000 tons of ammonium nitrate per annum) throughout the lease period, except as it may be prevented by strikes, accidents, fires, or other causes beyond its control, and further agrees:

(*a*) To determine by research whether by means of electric furnace methods and industrial chemistry there may be produced on a commercial scale fertilizer compounds of higher grade and at lower prices than fertilizer-using farmers have in the past been able to obtain, and to determine whether in a broad way the application of electricity and industrial chemistry may accomplish for the agricultural industry of the country what they have economically accomplished for other industries, and if so found and determined, to reasonably employ such improved methods.

(*b*) To maintain nitrate plant No. 2 in its present state of readiness or its equivalent, for immediate operation, in the manufacture of materials necessary in time of war for the production of explosives.

16. In order that the farmers may be supplied with fertilizers at fair prices and without excessive profits, the company agrees that the maximum net profit which it shall make in the manufacture and sale of fertilizer products shall not exceed 8 per cent of the fair actual annual cost of production thereof. In order that this provision may be carried out the company agrees to the creation of a board of not more than nine voting members, chosen as follows: The three leading representative farm organizations, national in fact, namely, the American Farm Bureau Federation, the National Grange, the Farmers' Educational and Cooperative Union of America, or their successors, shall each designate

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not more than seven candidates for said board. The President shall nominate for membership on this board not more than seven of these candidates, selected to give representation to each of the above-mentioned organizations, said nominations to be made subject to confirmation by the Senate, and there shall be two voting members of said board selected by the company. A representative of the Bureau of Markets, Department of Agriculture, or its legal successor, to be appointed by the President, shall also be a member of the board, serving in an advisory capacity without the right to vote. The said board shall determine what has been the cost of manufacture and sale of fertilizer products and the price which has been charged therefor, and, if necessary for the purpose of limiting the annual profit to 8 per cent as aforesaid, shall regulate the price at which said fertilizer may be sold by the company. For these purposes, said board shall have access to the books and records of the company at any reasonable time. In order that such fertilizer products may be fairly distributed and economically purchased by farmers, the said board shall determine the equitable territorial distribution of the same and may in its discretion make reasonable regulation for the sale of all or a portion of such products by the company to farmers, their agencies, or organizations. If and when said board can not agree upon its findings and determination, then the points of disagreement shall be referred to the Federal Trade Commission (or its legal successor) for arbitration and settlement, and the decision of said commission in such cases shall be final and binding upon the board.

17. Whenever, in the national defense, the United States shall require all or any part of the operating facilities at nitrate plant No. 2, for the production of materials necessary in the manufacture of explosives or other war materials, then the United States shall have the immediate right, upon five days' notice to the company, to take over and operate the same, and the company will supply the United States with hydroelectric power necessary for such operations, together with the use of all patented processes which the United States may need which the company owns or has the right to use. When required for national defense any of the company's personnel and operating organization necessary for operating any part of nitrate plant No. 2 in the maufacture of materials for explosives, or other war materials, shall be at the disposal of the United States. For the facilities and services aforesaid the United States shall protect the company from losses occasioned by such use and shall return the said property in as good condition as when received and reasonably compensate the company for the use thereof. All duly authorized agents and representatives of the United States shall have free access at all reasonable times to inspect and study all of the operatiaons, chemical processes and methods employed by the company at nitrate plant No. 2, providing that such agents and representatives shall not use the information and the facts concerning any of the company's operations, except for the benefit and protection of the United States.

18. In order that said company may be supplied with electric power and the farmers with fertilizers after the termination of the said one-hundred-year leases, should the United States elect not to operate said power plants but determine to lease or dispose of same, the company shall have the preferred right to negotiate with the United States for such lease or purchase and upon such terms as may then be prescribed by Congress.

19. As a method of procedure in the event of the violation of any of the terms of this proposal or any contracts made in furtherance of its terms, the company agrees that the Attorney General may, upon the request of the Secretary of War, institute proceedings in equity in the District Court of the United States for the Northern District of Alabama for the purpose of canceling and terminating the lease of Dam No. 2 or Dam No. 3, or both of them, because of such violation or for the purpose of remedying or correcting by injunction, mandamus, or other process any act of commission or omission in violation of the terms of this proposal or any contract made in furtherance thereof.

20. The above proposals are submitted for acceptance as a whole and not in part. Upon acceptance the promises, undertakings, and obligations shall be binding upon the United States and jointly and severally upon the undersigned, his heirs, representatives, and assigns and the company, its successors and assigns; and all the necessary contracts, leases, deeds, and other instruments necessary or appropriate to effectuate the purposes of this proposal shall be duly executed and delivered by the respective parties above mentioned.

Approved and signed by me at Dearborn, Mich., this 25th day of January, 1922.

HENRY FORD.

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MUSCLE SHOALS

HEARINGS

BEFORE THE

COMMITTEE ON AGRICULTURE AND FORESTRY UNITED STATES SENATE

SIXTY-SEVENTH CONGRESS
SECOND SESSION

ON

S. 3420

TO PROVIDE FOR THE MANUFACTURE OF EXPLOSIVES FOR THE USE OF THE ARMY AND NAVY, TO PROVIDE FOR THE MANUFACTURE OF FERTILIZER FOR AGRICULTURAL PURPOSES, TO INCORPORATE THE FEDERAL CHEMICAL CORPORATION, AND FOR OTHER PURPOSES; AND

ON

THE HENRY FORD MUSCLE SHOALS OFFER; OFFER MADE BY THE ALABAMA POWER CO., PROPOSING TO COMPLETE WILSON DAM; OFFER OF FREDERICK E. ENGSTRUM FOR MUSCLE SHOALS, AND OFFER OF CHARLES L. PARSONS FOR PROPERTIES AT MUSCLE SHOALS, ALA.

PART 3

Printed for the use of the Committee on Agriculture and Forestry

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MUSCLE SHOALS.

THURSDAY, MAY 4, 1922.

UNITED STATES SENATE,
COMMITTEE ON AGRICULTURE AND FORESTRY,
Washington, D. C.

The committee met, pursuant to adjournment, at 10.30 o'clock a. m., in the Commerce Committee room, Capitol, Senator George W. Norris presiding.

Present: Senators Norris (chairman), McNary, Norbeck, Harreld, Harrison, and Heflin.

STATEMENT OF MR. J. W. WORTHINGTON, CHAIRMAN EXECUTIVE COMMITTEE TENNESSEE RIVER IMPROVEMENT ASSOCIATION.

The CHAIRMAN. Give you full name, business, etc., to the reporter, Mr. Worthington.

Mr. WORTHINGTON. J. W. Worthington, chairman executive committee Tennessee River Improvement Association.

The CHAIRMAN. What is your occupation, Mr. Worthington?

Mr. WORTHINGTON. Well, I am not engaged in any business at all now, Mr. Chairman.

The CHAIRMAN. Are you not an engineer?

Mr. WORTHINGTON. I am an engineer by education, and have followed that profession in its various lines.

The CHAIRMAN. You are one of Mr. Ford's representatives here, are you?

Mr. WORTHINGTON. I represent Mr. Ford only to the extent that, having presented the Muscle Shoals project to him, I agreed that I would support before the Secretary of War and before committees of Congress, if it became necessary, the same facts that I presented to him, and that I would undertake to make as clear as possible that his proposal presented a new viewpoint with regard to joint navigation and power development.

The CHAIRMAN. You are here, as I understand it, advocating the acceptance of the offer made by Mr. Ford?

Mr. WORTHINGTON. I would rather say, if you are willing to let me put it that way, that I am defending the facts and that I support his offer.

The CHAIRMAN. I am not trying to put it at all.

Mr. WORTHINGTON. That is a fact, that I am here to defend and support the facts that were presented to Mr. Ford, that caused him to sign the offer. I will go further and say that I advocate its acceptance.

The CHAIRMAN. Are you in the employ of Mr. Ford now?

Mr. WORTHINGTON. No, no; not with respect to being in his pay. Oh, no.

The CHAIRMAN. That is what I wanted to get at.

Mr. WORTHINGTON. Oh, no.

The CHAIRMAN. And you have not been?

Mr. WORTHINGTON. I have never been.

The CHAIRMAN. You have traveled around the country somewhat advocating the thing in public speeches, have you not?

Mr. WORTHINGTON. No; I never have in public speeches.

The CHAIRMAN. Haven't you?

Mr. WORTHINGTON. No; never. The only thing that I ever have done, Mr. Chairman, is to present the engineering and economic facts as I felt they were justified in being presented.

The CHAIRMAN. Well, did you not make a speech down here?

Mr. WORTHINGTON. With that single exception, but I did not go there advocating anybody's proposal. I merely went there to present some facts in response to an invitation to address that organization.

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The CHAIRMAN. I was there, and I heard you, Mr. Worthington, and I had the idea that you were advocating Mr. Ford's proposal.

Mr. WORTHINGTON. No; those people asked me to address them, Mr. Chairman, and I broke my rule and I am very sorry for it.

The CHAIRMAN. I am not criticizing that course, but I want to get the truth in the record. You have a perfect right, of course, to advocate Mr. Ford's proposition anywhere and under any circumstances you please.

Mr. WORTHINGTON. Yes.

The CHAIRMAN. But, hearing you make that speech there, I had no other idea than that you were employed by Mr. Ford.

Mr. WORTHINGTON. Oh, no.

The CHAIRMAN. You were one of his engineers?

Mr. WORTHINGTON. No; not in the sense of being in his employ for pay at all; but, as I have just stated to you, having made the representations I did to Mr. Ford which caused him to make his offer of July 8, very naturally I would like to see its acceptance.

The CHAIRMAN. What interest, if any, have you in this? Are you interested in any real estate there?

Mr. WORTHINGTON. Not at all.

The CHAIRMAN. You do not have any interest in any of these various properties?

Mr. WORTHINGTON. No.

The CHAIRMAN. That are being offered on the market now?

Mr. WORTHINGTON. Not a dollar of property.

The CHAIRMAN. I understand that there is some organization in the city of New York that is advocating the sale of it. You have no interest in that?

Mr. WORTHINGTON. Oh, no. I do not know who they are, and I do not know that that was true.

The CHAIRMAN. Yes; I heard some one in this hearing say that he was in New York and saw a sign there——

Mr. WORTHINGTON. Mr. Chairman, I would like to make the statement here that I have not a dollar's interest in it, and I do not own anything in the world personally that it will have the slightest effect upon.

The CHAIRMAN. That is what I wanted to get into the record, Mr. Worthington.

Mr. WORTHINGTON. Yes.

The CHAIRMAN. That all bears upon your testimony.

Mr. WORTHINGTON. Yes.

Senator HEFLIN. Mr. Chairman, may I ask you what sign that was?

The CHAIRMAN. I do not know; I did not see it, but there was a sign there on somebody's office in New York City, saying, "Muscle Shoals property for sale," or something of that kind. I have heard that that was true.

Mr. WORTHINGTON. Mr. Ford made the same inquiry, and naturally, that you are making.

The CHAIRMAN. Yes. Well, you have nothing to gain or lose by the acceptance of this offer?

Mr. WORTHINGTON. Nothing at all.

The CHAIRMAN. What is your business now, Mr. Worthington?

Mr. WORTHINGTON. I have not any.

The CHAIRMAN. You are not following your profession?

Mr. WORTHINGTON. Not at all.

The CHAIRMAN. And you have not been?

Mr. WORTHINGTON. Except in so far as relates to this Muscle Shoals project.

The CHAIRMAN. How much of an examination have you made of the Muscle Shoals proposition? Have you gone into it professionally and have you made a close examination of the facts?

Mr. WORTHINGTON. Well, I have been studying it and following it, sometimes I have thought, very foolishly, for the last 15 years.

The CHAIRMAN. That was without being employed by anybody?

Mr. WORTHINGTON. Yes.

The CHAIRMAN. And just because you are interested in the development?

Mr. WORTHINGTON. Because I think that is one of the most unusual opportunities ever furnished to capital.

The CHAIRMAN. Now, with that preliminary statement, Mr. Worthington, go on in your own way and tell us anything you want to about this matter.

Mr. WORTHINGTON. Well, I think the best way that I can approach it would be from the standpoint of transportation and agriculture.

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Electricity has been the chief factor which has made most of the changes in our industrial and social life in this country in the last 25 or 30 years, but electricity has not been applied in any way to the farm, nor have we progressed in this country or have gone forward even as fast as smaller countries in Europe in the electrification of railways, so that this Muscle Shoals project furnishes an opportunity of seeing how we can improve the navigation of a stream and power jointly developed may be applied to agriculture and also to transportation.

Take Mr. Ford's proposition and contrast it, Mr. Chairman, with the Government's policy of improving rivers. The rivers and harbors appropriation from June 30, 1896, to June 30, 1920, amounted to $703,053,456.35. None of those appropriations returned either interest or any of the principal, and you might take the Ohio, just as an illustration, where the appropriations for the main stream and the tributaries, for maintenance and operation, amounted to a sum in excess of $142,000,000, without a dollar of return on the investment.

Now, contrast that with a tributary to the Ohio, the Tennessee, and take Mr. Ford's offer, in which he proposes to pay 4 per cent upon the appropriation and establish a retirement fund that will return to the United States its investment. Take Dam No. 3 as an example, and you have the cost of the improvement of navigation free. Not only is that true, but a more important thing, in a way, is true—that you create power at the same time, which, in its distribution, goes to the solution of our troubles and problems of transportation.

So it does seem that if such a policy as he proposes could be adopted and it could be applied to other rivers in the country, where joint navigation improvement and power development can be made, it would be one of the most highly economic and interesting propositions ever made.

Take your Panama Canal, and suppose that could have been placed on the same footing. The Panama Canal cost $380,554,949. The gross income of all kinds in the year 1920–21 was $12,040,117. The operating expenses were $9,328,300. Interest at 3 per cent on the net investment was $11,416,648. If the investment of the Government in the canal had been required to pay 3 per cent interest on the total, there would have been a shortage or a deficit, you might say, of $20,410,769. That is, if you should require the Panama Canal to meet the terms of Mr. Ford's proposal the Panama Canal would have gone into the hands of a receiver.

Take reclamation projects established some 20 years ago. The net investment on June 30, 1921, was $125,870,830. The gross income required to meet the terms of the Ford offer would have been $10,179,932. The actual gross income for the fiscal year ending June 30, 1921, was only $4,191,684, a shortage, if it had been subject to the same terms and conditions as the Ford offer, of $5,988,248.

The CHAIRMAN. It would have been a much larger shortage if you had taken a year further back, away at the beginning.

Mr. WORTHINGTON. Yes, sir.

The CHAIRMAN. When they had no income?

Mr. WORTHINGTON. The point that I would like to expressly direct your attention to is this, that if it is a sound governmental policy to make appropriations for these reclamation projects and not charge any interest, but slowly get the return of the principal invested by the Government, will it not be a perfectly sound and economic thing to do to accept Mr. Ford's offer, who proposes to pay 4 per cent on your money and return it to you; and, especially, is it not a parallel case, or can not be denied that what is proposed at Muscle Shoals with respect to agriculture and farm production is on all fours with the Roosevelt Dam?

The CHAIRMAN. Well, do you think it is on all fours with the reclamation projects?

Mr. WORTHINGTON. Oh, I most undoubtedly do.

The CHAIRMAN. If you would try to finance the reclamation projects on the same theory, with a view of getting back the money—in other words, charging interest—you would fail.

Mr. WORTHINGTON. Exactly.

The CHAIRMAN. You would be bound to fail.

Mr. WORTHINGTON. And, therefore, I would like to suggest that if you grant that it would fail, then how much more forced are you to accept the Ford offer, which will not fail?

The CHAIRMAN. Mr. Worthington, I have been all over some of those reclamation projects, and I remember one in particular where the Government's project carried its canal around above a private corporation. They had the choice; they were in there first; they had the bottom land to irrigate. The Government took

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the rougher land above that, and I stood above that dam near where they began to converge, where they came out of the river, although they came out quite a number of miles apart, where I could see them both. Now, with all of its advantages, this privately owned ditch was a failure. The farmers were not able to pay the interest and meet the payments. Just above them, where they did not have quite as nice land to irrigate under the Government ditch, they were a success and were doing fine. The Government's proposition was successful. The privately owned corporation—a corporation that everybody praises to the skies and which everybody says is much more efficient than Government operation—was a failure.

Mr. WORTHINGTON. Yes.

The CHAIRMAN. And they lost a whole lot of their money there. These men invsted their money there, and they did it in good faith; they were doing the best they could, and the only difference between the two propositions was that one bore interest and the other one did not. There was success on the one hand, and there was a failure on the other hand. There was success to the Government's enterprise and failure to the privately owned enterprise.

Mr. WORTHINGTON. That is quite true; but I hope I get my point before you, that if you can make appropriations for reclamation projects which do not pay any interest, that, at least, presents the Ford offer very attractively.

The CHAIRMAN. Probably.

Mr. WORTHINGTON. Since it does pay for it.

The CHAIRMAN. But I do not really see its application in comparison with a reclamation proposition. I think it is so entirely different.

Mr. WORTHINGTON. Well, might I put this thought before you in support of my contention that they are parallel, that if it is a sound policy to make the appropriations that you have, aggregating since the beginning 175,000,000, and you have——

The CHAIRMAN (interposing). Yes; more than that; is it not?

Mr. WORTHINGTON. Not much more than that.

The CHAIRMAN. I was under the impression that it was more than that.

Mr. WORTHINGTON. It is about a net of $125,000,000. The difference has been paid back to you. It is just as desirable; it is just as necessary to renew the fertility of the soil of these lands that have been made nonfertile by long use, and make them fertile again, as it is to take water and distribute it out over the arid lands that will not grow crops without the water.

The CHAIRMAN. I will agree with you on that.

Mr. WORTHINGTON. That is one point that I want to make.

The CHAIRMAN. I think it is a national problem.

Mr. WORTHINGTON. Yes.

The CHAIRMAN. That after all is said and done it is not really for the benefit of the farmers but for the benefit of all others.

Mr. WORTHINGTON. Perhaps so.

The CHAIRMAN. Because the benefit to the farmer is bound to redound to our benefit in the cost of living.

Mr. WORTHINGTON. Absolutely, sir.

Now, before leaving the question of navigation improvement I would like to impress upon the committee that there never has been proposed before any plan under which the cost of navigation improvement could be paid back into the Treasury by power users or users of products produced by power.

The CHAIRMAN. Well, somebody has to pay it; it is paid back. On the other hand, if the Government did it and owned it itself and never got it back, the benefit would reach the people in the same way in the reduced prices that they would pay for fertilizer.

Mr. WORTHINGTON. Well, you enter upon a phase of the case that I would naturally have to let go by, because as to whether Muscle Shoals ought to be developed and operated by the United States Government or whether it is better to accept Mr. Ford's offer is a matter for your committee and Congress to decide and an expression of my personal opinion would not change the case at all; but I do not mind saying very frankly that I think the people of this country—the taxpayers and the consumers of the products that may be purchased there—would fare better under the Ford plan than under any Government-operated plan. That is a matter of opinion, however. One thing we could agree about is that somebody ought to do it, couldn't we?

The CHAIRMAN. I think so. I think we are all agreed on that.

Mr. WORTHINGTON. I would like to stress one point a little further—that power development at a dam that gives splendid slack-water navigation at the

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same time is so desirable and so economic that it does seem that the Ford offer, whether accepted or not, suggested the policy that might be adopted generally by the Government, if you do not want private enterprise to do it.

Take the Tennessee River as an example, and the Government operation, together with its history of navigation improvement; and while I do not pretend to contend with you, Mr. Chairman, that the Government methods will not be changed—they may be—however, it is a fact that the Government of the United States started the navigation improvement of the Tennessee River in the year 1828, and it is easily conceivable—indeed, Mr. Ford has stated that he felt that a river ought to be taken up as a whole and completed in its entirety, and that the water resources of a river ought to be made available to navigation of the stream, for the furnishing of cheaper power than coal will furnish, and then, perhaps, electrify our railroads and get cheaper freight rates.

On that score, Mr. Chairman, I think this Muscle Shoals case furnishes the opportunity to do just exactly what Mr. Ford says he would like to do—namely, make it a great example.

Take the Chicago, Milwaukee & St. Paul Railway, operating a total of 646 miles of main line, electrical divisions, and 860 miles with sidetracks included. The estimate is—and it is over the signature of the president of the Chicago, Milwaukee & St. Paul Railway—that electric operations save annually about 260,000 tons of coal and about 32,000,000 gallons of oil. The saving in avoiding the use of this fuel is not only in the value of the fuel itself, but it eliminates the hauling of nonrevenue traffic for fuel amounting to nearly one-third, Mr. Chairman, of the total coal hauled by the railroads.

The 44 electric locomotives have replaced 120 steam locomotives, and it would have required 210 cars moving continuously to handle the coal for these steam locomotives on one division alone.

Now, at this point, please, I would like to stress this point. It was not a necessity to electrify the Chicago, Milwaukee & St. Paul Railway. The road was electrified because of the availability of water power. The electrification of the Chicago, Milwaukee & St. Paul Railway has reflected a reduction of 22.5 per cent in the number of trains and has cut down the time of the trains 24.5 per cent. It has so improved operating conditions that 30 per cent more tonnage can be handled in 80 per cent of the time, and this means an increase of at least 50 per cent in the capacity of its trains, and probably more.

The CHAIRMAN. It will be interesting there, if it will not interfere with your outline, to tell us as you go along what that power costs. Do you have that?

Mr. WORTHINGTON. Three mills. We will insert it at three mills per kilowatt hour, with the reservation that we may check that up.

The CHAIRMAN. Yes. That is not as cheap power as we are going to get at Muscle Shoals, if we are not disappointed as to what happens, if our dream, as you may call it, comes true of developing that power and getting everything out of it.

Mr. WORTHINGTON. Yes; if you work out the entire river.

The CHAIRMAN. As we ought to do.

Mr. WORTHINGTON. Yes; as you ought to do.

The CHAIRMAN. Yes.

Mr. WORTHINGTON. And you can not embrace the real economies until you do it.

The CHAIRMAN. No; you can not tell what they are going to be, but some of us have been dreaming about that hope it will be a cheaper power than the Milwaukee road gets.

Mr. WORTHINGTON. I think so; yes. The electrification of railways doubles the capacity of trackage and postpones for a long term of years the time when double tracking will be necessary.

Now, all such phraseology as I have just pronounced amounts to nothing unless there is something practicable about it, but already the president of the Louisville & Nashville Railroad says that if Mr. Ford develops this power and will let the road have the power, he would proceed to electrify at least one division.

The CHAIRMAN. Now, you have struck a point that has a very important bearing on Mr. Ford's proposition.

Mr. WORTHINGTON. Yes.

The CHAIRMAN. The Louisville & Nashville Railroad will electrify if Mr. Ford will let them have it. Now, should the Government place this great development on this river and all of that wonderful power in the hands of one man and let him say where it should be used and who should have it?

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Mr. WORTHINGTON. In answering that I can only give you my personal view, and yet I repeat that I doubt whether that would amount to anything if I did. but I answer yes, and I further suggest, since you bring up the question, that the people of this country would approve of it.

The CHAIRMAN. And the next river we develop we will give to some other man, some other big millionaire.

Mr. WORTHINGTON. I am going to ask you to let me differ with you there.

The CHAIRMAN. Oh, you would only give it to Mr. Ford, then?

Mr. WORTHINGTON. I am going to, because his purposes are very well known. What inspires Mr. Ford, what Mr. Ford desires this power for, is the thing, and if he gets the power, and in the course of time sins against public interest, you will have an example that will guide you in legislation to protect the country in the future.

Senator MCNARY. May I ask you at this point what are those desires other than those expressed in his proposal?

Mr. WORTHINGTON. Oh, I feel, in answer to your question, Senator, that what is expressed in the proposal itself is a reply to your question, because I do not think it has ever happened where a great industrial figure in this country became involved in a proposal to enter into a field of possibilities, to take the risk and say to the Government, "If you will join me in this I will let your own governmental agencies look in and see just exactly what I am doing in respect to fertilizer, and control, and, in fact, regulate the prices." As to his purpose. I can not commit Mr. Ford. I would not think of doing so.

Senator MCNARY. Well, you elected——

Mr. WORTHINGTON. But I will suggest to the committee that he rather surprised me. In presenting this case to him I supposed he was like other business men of his type that I have met, and I naturally undertook to show him where he would make money, and more than once he called me down on that angle of the case and said: "That is not what I am after." I have no doubt in my mind whatever that Mr. Ford is perfectly sincere about his intentions at Muscle Shoals, to make Muscle Shoals and the Tennessee River an example of what our water-power resources on our rivers will do for the people of this country.

The CHAIRMAN. It is not necessary to question Mr. Ford's sincerity. I have not heard it questioned by anybody on the committee, at least, in oppositon, even. to the acceptance of his offer.

Mr. WORTHINGTON. He stated a number of times to me that he was not going to Muscle Shoals to make money.

Senator MCNARY. Now, Mr. Worthington, assume that. He will not always survive this mortal life. I suppose he is a man whose expectancy of years is not so very great. This is a 100-year proposal. What are we to do with the other 85 years, assuming that he lives 15 years longer. Have you thought of that?

Mr. WORTHINGTON. I have.

Senator MCNARY. It may be a man who is entirely commercial will take Mr. Ford's place after the latter's death, and we will be tied up to him for 85 years. He may use the power for private gain rather than for public good. There is the other side of the picture.

Mr. WORTHINGTON. I have thought of that; but I feel, in view of our failure in this country to embrace the possibilities of water-power development, as compared, for instance, with Canada, we have lost so much by hesitation and delay that it could be expected in the interests of the country that there would be legislative courage equal to Mr. Ford's courage, and I further think that the people of this country will approve, and I think Congress has shown that it will take care of the situation when it gets to it.

Senator NORBECK. Well, if we sign our rights away first, it will be rather difficult to take care of it, will it not?

Mr. WORTHINGTON. I do not think so. I think whenever the American people make up their minds to do anything they can do it, I do not care what it is.

The CHAIRMAN. As the Senator suggests, we would not want to do anything that would put our successors where they could not help themselves. As the Senator suggests by his question, suppose we sign away these rights. Future Congresses would be bound by that unless they violated our agreement, which, perhaps, even the courts would not permit to be done, and which, I take it, no fair-minded citizen would want to be done. The people would want us to keep our word.

Mr. WORTHINGTON. Your question indicates that you think that is a very valuable property.

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Senator NORBECK. I do.

Mr. WORTHINGTON. All right.

Senator NORBECK. I judge that by the figures put in as to the capital and what they are asking for in the way of appropriations to complete it.

Mr. WORTHINGTON. Yes.

Senator NORBECK. I certainly think it is valuable.

Mr. WORTHINGTON. In paragraph 19, as clarified, it states that:

"As a method of procedure in the event of the violation of any of the terms of this proposal, or any contracts made in furtherance of its terms, the company agrees that the Attorney General may, upon the request of the Secretary of War, institute proceedings in equity in the District Court of the United States for the Northern District of Alabama for the purpose of canceling and terminating the lease of Dam No. 2 or Dam No. 3, or both of them"——

Senator NORBECK. If there is a violation of the terms of the written contract, not the spirit of it, the written contract is not even with Mr. Ford, but with a corporation to be created, and we do not know who those stockholders would be. The stock may not even be held in Mr. Ford's family. You and I may be holding some of that stock in 20 years from now.

Senator HEFLIN. But, Senator, the contract has not yet been written, and all of that can be stipulated into it.

Senator HARRELD. Mr. Worthington, right along that line, we have the water power act at the present time, which provides for a 50-year tenure of water power, and provides that the Government may, on its own motion, at any time under certain regulations and conditions, take it over. Now, Mr. Ford comes in here, clearly outside of the expressed intention of Congress, and he is asking to lease this and not be governed in any sense of the word in accordance with the intention of Congress in the past as expressed in the water power act. Why does he do that? Why does he not want to get this project under the terms of and subject to the control as prescribed by and provided for in the water power act?

Mr. WORTHINGTON. First, Senator, because the magnitude of this undertaking, the risk of the undertaking, is too great to undertake within a period of 50 years.

The field of electrochemical operations is a very different matter from the general utility business. It takes a great volume of property, and it takes a great deal of capital, and all along Mr. Ford has had only one viewpoint that he insists on. He says that the burden of interest for capital in hydroelectric developments, which goes on, you may say, perpetually, is a thing that is so contrary to the economic industrial welfare of this country that it ought to be stopped. I do not think he would yield that viewpoint at all.

Suppose we apply the 50-year policy in the water power to Mr. Ford's offer. The effect of the 50-years on an amortization fund of $1 per year at 4 per cent for 50 years is $158. A dollar per year at 4 per cent for a hundred years is not twice $158, but it is $1,287. A 50-year refund requires more than eight times the annual amortization charge that a hundred-year fund requires.

Now, your question, Senator, brings us into a field in which Mr. Ford has shown the very greatest interest, and I believe it is safe to say to the committee that one of the things he is most interested in in connection with the making of Muscle Shoals an example and an object lession is that at the end of the lease the cost of power will be reduced to the cost of operation and maintenance, and, while some have insisted that he is trying to drive a close bargain to get the United States to furnish him 4 per cent money, so that he will have the advantage of somebody else, the charge is not only untrue, but it is very unfair.

Senator MCNARY. Now, let us analyze that statement a moment and see if it is absolutely correct. The amortization applies only to the construction of Dam 3 and the construction of Dam 2. It has no reference to the other investment made by the Government, amounting to practically $90,000,000, save the $5,000,000 that he pays for the property and for which he gets the fee simple title to it.

Mr. WORTHINGTON. May I be indulged, Senator, to come to that phase of it a little later on?

Senator MCNARY. It is a very easy matter to get a hundred dollars and pay $1 back and amortize it, but that is a different thing from taking the whole sum.

Mr. WORTHINGTON. Yes; I feel the force of your suggestion, but I wonder if you would let me come to justify that side of it, which he refers to in the nitrate-plant operations.

Senator HARRELD. Let him finish the answer to my question first.

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Mr. WORTHINGTON. And deal with this particular case here that the Senator has asked me about.

To illustrate what a burden on industry the interest charge of capital invested in power developments is, just take the case of 100,000 horsepower, for example. Suppose we take an investment at $200 per horsepower and that we assume a retirement rate at 4 per cent on the principal and interest on the same at a given rate for a period of 50 years, and I call your attention to 100,000 because you might work out a project of that size under the general dam law, which I hope is in part an answer to your question, Senator.

If you take a rate of interest at 2 per cent on a power development costing $200 per horsepower, the fixed charge per horsepower is $4 per year. If you take that rate at 3 per cent, it is $6 per horsepower per year. If you take 5 per cent, it is $10, and if you take it at 6 per cent it is $12.

The CHAIRMAN. What is it at 4 per cent?

Mr. WORTHINGTON. And at 4 per cent it is $8; at 7 per cent it is $14; at 8 per cent it is $16, and at 9 per cent, which I expect could be taken as pretty nearly the average rate that power companies have to pay for money, you have $18 fixed charge.

The CHAIRMAN. Now, Mr. Ford, in his proposition, instead of paying 9 per cent, will pay 4 per cent.

Mr. WORTHINGTON. Yes.

The CHAIRMAN. It is not quite 4; it does not amount to 4 per cent, because he does not commence to pay until the dam is completed, and the government has to put up all the money before it is completed.

Mr. WORTHINGTON. Yes; but you must remember that it is your dam and he is leasing it.

The CHAIRMAN. Yes.

Mr. WORTHINGTON. If you were building a skyscraper you would not expect Mr. Ford to pay room rent before it was finished?

The CHAIRMAN. No; but the government is not getting quite 4 per cent for its money.

Mr. WORTHINGTON. Well, it would be fair to say, under the policy of your river improvements and your appropriations for the same, like on the Ohio and other rivers of the country, something should be charged to navigation.

The CHAIRMAN. Oh, yes; I think that is true.

Mr. WORTHINGTON. I think that is fair.

The CHAIRMAN. Yes.

Mr. WORTHINGTON. The Secretary of War felt that way.

The CHAIRMAN. That is, for the Government; that is true.

Mr. WORTHINGTON. Yes.

The CHAIRMAN. But that does not change the fact at all that Mr. Ford is going to get his money at this particular rate of interest.

Mr. WORTHINGTON. Well, who pays for it. Suppose we take the operation of that nitrate plant at No. 2 and consider his offer. If you charge him 8 per cent, the buyer of the fertilizer would pay for it.

The CHAIRMAN. Yes. I am not complaining about that. I am considering it in connection with the dam.

Mr. WORTHINGTON. So a higher rate of interest would not be justified.

The CHAIRMAN. But the facts are, nevertheless—and we cannot get away from them, and it is not necessary, of course, to even try to get away from them; but what I want to get at is just exactly as it is—that Mr. Ford is paying 4 per cent interest. He can sell it to the Louisville & Nashville Railroad, if he wants to, or use it himself. The Government cannot fix that, as you said a while ago. It is for Mr. Ford to say whether the railroad shall use it or whether Mr. Ford shall use it; but Mr. Ford's representative said that he is going to invest fifty million dollars himself in building machinery down there, and if he is going to use it he is getting the money at four per cent interest. There do not seem to be two ways about that.

Mr. WORTHINGTON. As to Mr. Ford's offer, whether it is accepted or not, I would like to point out how sound the economic principle is that he stands for, that eight and ten and twelve per cent money should not be invested in the navigation and power dams of this country.

The CHAIRMAN. Well, but you say it is.

Mr. WORTHINGTON. We know it is.

The CHAIRMAN. Yes; I agree with you.

Senator HARRELD. Now, Mr. Worthington, under this contract here we would give to Mr. Ford a hundred-year lease. Then, under the water power act,

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we would give to some other man certain other water power, but limit it to 50 years in one lease.

Mr. WORTHINGTON. Yes.

Senator HARRELD. In that event, have you not given Mr. Ford an unfair advantage over the fellow that takes the lease under the water power act?

Mr. WORTHINGTON. I do not think so.

Senator HARRELD. It will perhaps affect his right, and even his power, to cope with him in rates, etc.

Mr. WORTHINGTON. First, I do not think so, because I do not think there is anything iron-bound or ironclad about 50 years. I think, Senator, if you would search the history of legislation, you will find that it was a compromise.

Senator HARRELD. I understand that, but——

Mr. WORTHINGTON. And that there is nothing sacred about it, and, moreover, I am sure you will not contend, will you, that if you were investing your money in a project involving 750,000 horsepower, say, that you would want the time to be exactly the same as your neighbor over there, who had only 100,000? Not only that, Senator, this is not the first time you have done it. You have, for instance, at Lock 12, on the Coosa River, where Congress gave a perpetual grant, and at ——

The CHAIRMAN. Will you give the dates, if you have them there?

Mr. WORTHINGTON. Well, the first legislation on the subject was probably as early as 1907. May I just be permitted to insert those dates?

The CHAIRMAN. Yes; certainly.

Mr. WORTHINGTON. I can not recall them exactly.

Data on legislation regarding certain power dams built in navigable streams prior to passage of Federal water power act.

Licensee.	Project.	Date of permits.	Dates of act or amendment.	References.
Alabama Power Co.....	Lock and Dam No. 12, Coosa River.	Mar. 3, 1910.....	Mar. 4, 1907.....	34 U. S. 1288.
Mississippi River Power Co., successor to Keokuk & Hamilton Water Power Co., grantee.	Lock and dam near Keokuk, Iowa, Mississippi River.	May 9, 1908, modified Mar. 6, 1911.	Feb. 8, 1901; Feb. 26, 1904; Feb. 9, 1905.	31 U. S. 764; 33 U. S. 56; 33 U. S. 712.
Chattanooga & Tennessee River Power Co., successor to C. E. James and J. E. Guild, grantees.	Lock and dam at Hales Bar, Tenn., Tennessee River.	May 24, 1905; Aug. 23, 1905; Sept. 2, 1905; July 13, 1908.	Apr. 26, 1904; Jan. 7, 1905; Mar. 3, 1905; Aug. 5, 1909.	33 U. S. 309; 33 U. S. 603; 33 U. S. 1133; 36 U. S. 181.

The CHAIRMAN. That is the reason I asked the question. Have we any other legislation of that kind by Congress since the passage of the water power act?

Mr. WORTHINGTON. Oh, no.

The CHAIRMAN. That was when Congress declared its policy?

Mr. WORTHINGTON. Yes; but I was leading up to it——

The CHAIRMAN. Before that these acts were separate and specific acts. The Coosa River one was vetoed, was it not, by the President?

Mr. WORTHINGTON. No, sir. President Roosevelt finally approved it, and it was extended afterwards, and the Alabama Power Co. built the dam at Lock No. 12 under that special act.

The CHAIRMAN. Perpetual?

Mr. WORTHINGTON. Yes; perpetual.

The CHAIRMAN. Congress passed one act. I remember—I do not know whether that was the one or not—which permitted the Alabama Power Co. to develop a dam.

Mr. WORTHINGTON. That was at 18, vetoed by the President.

The CHAIRMAN. On the Coosa River?

Mr. WORTHINGTON. Yes; at 18.

The CHAIRMAN. And the President vetoed that?

Mr. WORTHINGTON. Yes; the President vetoed that. They are building the dam now.

The CHAIRMAN. Under the general water power act.

Mr. WORTHINGTON. Near there.

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The CHAIRMAN. As I remember it, the object of the veto there was as to the perpetual right, was it not?

Mr. WORTHINGTON. Oh, no.

The CHAIRMAN. Was it not? I have forgotten it.

Mr. WORTHINGTON. You gave it under the law of 1910.

The CHAIRMAN. No; it was a special act, the one that was vetoed.

Mr. WORTHINGTON. No; it was the act of 1910. Here it is right here.

The CHAIRMAN. Well, there could not be any such thing as a veto if it was under the general law.

Mr. WORTHINGTON. Yes; here it is.

The CHAIRMAN. A veto only applies to an act of Congress.

Mr. WORTHINGTON. No; a veto by the President.

The CHAIRMAN. Then it was a special act.

Mr. WORTHINGTON. Every dam under the law of 1906 and 1910 required——

The CHAIRMAN. No; it was a law that we passed and the President vetoed it.

Mr. WORTHINGTON. Oh, no.

The CHAIRMAN. Of course, Mr. Worthington, your position is not right. The President does not veto a contract. He can only veto acts of Congress.

Mr. WORTHINGTON. Well, he did veto an act of Congress granting this company the right to build a dam on the Coosa River.

The CHAIRMAN. Yes; he vetoed that.

Mr. WORTHINGTON. Yes, sir.

The CHAIRMAN. The building of that dam was controlled by the act which he vetoed, and not some general act.

Mr. WORTHINGTON. Well, I would not pursue it at all. I just leave it with you to look at, because your decision will be final with me, whatever it might be. I was very familiar with the case, and you will remember that the law of 1910 provided that Congress should pass a separate grant under the law for every case.

The CHAIRMAN. Yes.

Senator HARRISON. It was a separate bill that was passed through Congress touching on the Coosa River proposition.

Senator HEFLIN. Giving permission to build this dam?

Mr. WORTHINGTON. Yes.

Senator HEFLIN. That is what he means.

The CHAIRMAN. Yes; that is what I mean, of course.

Senator HEFLIN. As a result of the veto, this cyanamid company, operating at Niagara Falls, went out of the country, and it would have been operated on the Coosa River.

Mr. WORTHINGTON. Let me suggest that it was vetoed because they could not agree on what to pay for the use of the water, but that is an old discussion and is settled now.

I would like to suggest here that, in addition to such statement as I have made to you, Senator, in support of a hundred years that, first, this is not a water power project of the kind contemplated by the present power act. It goes very much farther and has a specific purpose in Mr. Ford's offer, and indeed its primary purpose is to see if the ammonia problem of this country can be worked out.

Senator HARRELD. Well, that might be the purpose of any water power act.

Mr. WORTHINGTON. It might be, but no water power act yet has so declared, and it just happens, does it not, Senator, that the power companies are opposing the Ford offer.

The CHAIRMAN. I do not know as to that.

Mr. WORTHINGTON. Well, it is not, indeed, a thing that I might with propriety mention, but I heard that it was. I would not press the point.

The CHAIRMAN. Well, I do not know, either. I do not know that that is material.

Mr. WORTHINGTON. No.

The CHAIRMAN. But I have not heard anything on that point. I confess, now that you have mentioned it, I feel interested in it.

Mr. WORTHINGTON. I would like to suggest that it does seem to me that, if not unfair, at least it is a very severe test of the fairness of your present power act, to expect Mr. Ford to invest such a large capital as he is going to be called on there to invest, if he ever works this proposition out, and ask him to accept 50 years when the Aluminum Company of America, using the Tennessee River has perpetual rights.

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The CHAIRMAN. Now, right on that point, Mr. Worthington, you say when he proposes to invest so much money there.

Mr. WORTHINGTON. Yes.

The CHAIRMAN. Under Mr. Ford's proposition, can that corporation, as provided for, be required to invest anything in development there? Could it be required to invest a penny?

Mr. WORTHINGTON. Well, you will not have to require him if you accept this. He has to do it or quit.

The CHAIRMAN. I know; but the Government furnishes the money to complete the dam.

Mr. WORTHINGTON. Oh, that is different.

The CHAIRMAN. Under that contract, where would he have to invest any money?

Mr. WORTHINGTON. He is bound to invest money in this nitrate plant if he ever works it out.

The CHAIRMAN. No.

Mr. WORTHINGTON. Oh, yes.

The CHAIRMAN. No.

Mr. WORTHINGTON. Why not?

The CHAIRMAN. He can work it as it is now.

Mr. WORTHINGTON. Then, we get into this field——

The CHAIRMAN (interposing). I assume that he will do that. I am coming down to a technical proposition, but I do not know of a thing in his offer there that requires him to invest a penny.

Senator MCNARY. $5,000,000 to acquire the property, Mr. Chairman.

The CHAIRMAN. Yes; he would have to pay that, of course.

Senator MCNARY. Yes.

The CHAIRMAN. He can take the power, when it is developed, and instead of building factories there, as he probably will, and as you say he will, but it is not in the contract, and sell it to the Louisville & Nashville Railroad or to the Alabama Power Co. or to anybody else, for any price he sees fit, without any governing board or without any rules or regulations by anybody representing the Government of the United States? Can he not do that under his own proposition?

Mr. WORTHINGTON. Well, in the first place, and in answer to that question, he could not sell this power to the Alabama Power Co., because it can not use it along the lines of its present service.

The CHAIRMAN. They are anxious to buy it. They have made a bid for it, and you say the Louisville & Nashville Railroad wants to buy it.

Mr. WORTHINGTON. Well, Mr. Mapother said that he would be willing to test out one division.

The CHAIRMAN. Is it not true that under this bid, that outside of the $5,000,000 he pays, he is not required to invest anything? I am not saying that he does not intend to, but I want to make the point that that contract does not compel him to; it does not compel this corporation that he is going to organize, to do it. Now, to be technical, is not that true? If it is not I want it pointed out to me.

Mr. WORTHINGTON. It probably is true; but it could not possibly——

The CHAIRMAN (interposing). Now, what assurance have we that this corporation which he is to organize, when he dies, will not be technical and stand on its technical rights?

Senator MCNARY. May I add, Mr. Chairman, that Senator Norbeck calls my attention to the fact that the capital stock of the corporation is $10,000,000. After paying $5,000,000 for the plant they would have only $5,000,000 with which to operate, unless they borrowed money.

The CHAIRMAN. Well, they do not need to operate, except this nitrate plant.

Senator HEFLIN. But he obligates himself to make fertilizer.

The CHAIRMAN. Yes; I say he is to operate the nitrate plant.

Senator HEFLIN. And Mr. Mayo says he is going to manufacture fertilizer on a large scale, and if he does, he will have to invest a good deal of money there. He also suggested that he thought he had a new process by which he thought he could operate.

The CHAIRMAN. Yes; I am putting my question purely as a technical proposition. When Mr. Ford dies, I am assuming that the corporation will be just as technical as they can, as the contract will permit them to be.

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Mr. WORTHINGTON. I believe, in order to get along and present the viewpoints that I am rather imposing upon the committee, I would like to direct attention to what seems to be the fundamentals of this thing. There is no problem in this country that is appealing so for solution as the ammonia problem.

Now, while in the past few years the production of phosphoric acid by the electric-furnace process has been commercially solved, and only waits to be put on the volume production basis, the production of ammonia has not been solved. We have got in this country all of the nitrogen we want. There is no shortage of it. It is the cost; and right there I wish to leave this thought with the committee, that is, you decide that what appear to be the possibilities at Muscle Shoals to solve the ammonia problem of the country, Mr. Ford proposing to take the first step—if you insist that those possibilities be written into a contract, I think your case is hopeless.

Senator NORBECK. But Mr. Ford says he will do that providing he can make 8 per cent profit.

Mr. WORTHINGTON. He says he will not charge more than 8 per cent.

Now, if I might continue, suppose this committee to-day was sitting on the case of the Little Tennessee River, and you were back 18 years ago and the Aluminum Co. of America had come here and asked you for a hundred-year grant of that power, and they have perpetual right to it. I think perhaps you have a case there which will at least give the opportunity to make the point that you would perhaps take the same position that you do now about this fertilizer. You would want to have written into the agreement the possibilities, and if you had asked the Aluminum Co. of America 18 years ago on the Little Tennessee River to have contracted and obligated itself to have produced the alloys that they produce to-day you would have driven them away absolutely. They did not know. And just as the Aluminum Co.'s industry in this country has been an evolution, and has gone to its present wonderful position by experience, large capital expenditure, even to the point, Mr. Chairman, that there is 400,000 horsepower applied to that single industry in the United States, so the ammonia industry must be developed, yet not a horsepower is applied to the ammonia industry by these electro chemical methods in this country to-day.

The CHAIRMAN. How much at the Little Tennessee? That is probably right. How much horsepower?

Mr. WORTHINGTON. About 350,000 to 400,000 horsepower.

The CHAIRMAN. How many dams?

Mr. WORTHINGTON. Seven proposed.

The CHAIRMAN. They are not all completed yet?

Mr. WORTHINGTON. No, sir.

The CHAIRMAN. That was about 18 years ago—the granting of the right?

Mr. WORTHINGTON. Oh, no. They did not need a grant. It is not on a navigable stream. It just so happens that the United States Engineers had never designated the Little Tennessee as a navigable stream.

The CHAIRMAN. Then, as a matter of fact, it has not been granted by the Federal Government?

Mr. WORTHINGTON. Not at all.

The CHAIRMAN. Just the State?

Mr. WORTHINGTON. They just went there as riparian owners.

The CHAIRMAN. I see. Then, you can not cite that as a precedent for our action here?

Mr. WORTHINGTON. Oh, no; but I can cite that to say that if it was thought to be a sound thing and desirable to have a perpetual right to the water of the Little Tennessee, and that it is a good thing for the country in developing the aluminum industry, then it is not an unfair thing to say that when the Little Tennessee waters get to the Muscle Shoals Mr. Ford should have a hundred years.

Senator NORBECK. I don't think that is a good thing for the country, but it is a good thing for the real-estate owners right around it. It was not anything done by Congress, but it was something that was just permitted because there was no law concerning it.

Senator MCNARY. Is there anything unique in Mr. Ford's offer concerning the fixation of atmospheric nitrogen at this plant? Does not the Alabama Power Co. agree to supply the Government sufficient water power to operate this plant No. 2 to full capacity?

Mr. WORTHINGTON. Yes, sir. The Alabama Power Co. proposes to furnish the secondary power.

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Senator McNARY. Let me ask you this question: I think we are all in accord in the thought that what we want to do is to solve the ammonia question. But supposing a process was discovered that was cheaper than the cyanamid or the Haber or the arc processes, would not the Government be in position to operate the plant and every item of horsepower for that great purpose?

Mr. WORTHINGTON. Well, in answer to that question, the Government could be in a position to do so, but you have to remember that the Government has had some time to move in this matter and it never has moved.

Senator McNARY. So that if you are going to place this whole proposition upon a fertilizer basis, we only have Mr. Ford tied up to approximately 110,000 tons of sulphate of ammonia.

The CHAIRMAN. No; not sulphate of ammonia.

Mr. WORTHINGTON. No; ammonium nitrate.

Senator McNARY. Oh, yes; ammonium nitrate, then. We only have him tied up to 110,000 tons, where there is a sufficient horsepower to make, perhaps, 10 times that much, and if it was found to be a good thing the Government could go ahead and do the very thing you want, whereas we could not compel Mr. Ford's organization to do it for a hundred years, and you couldn't then, even.

Mr. WORTHINGTON. That is, of course, for you gentlemen to decide, and I would like to continue on this ammonia problem just a little, please, if I might.

The CHAIRMAN. Yes, sir.

Mr. WORTHINGTON. When the aluminum industry was put on a water-power basis aluminum was worth $1.25 to $1.50 a pound. It is now selling, I believe, as low as 17 cents a pound, with quite a number of very useful alloys. I think that it is fair to expect that in part the committee will have to show some confidence in Mr. Ford. If they are not willing to back his courage—it is the most courageous proposition that any business man ever made in this country, and he is willing to undertake the solution of the ammonia problem of the country. It is a question solely to decide whether you will permit him to undertake it or whether you will undertake it yourselves. Now, in undertaking it one may have confidence that the Government will accomplish it, but I venture to suggest to you that you may discover, for instance, a process like, for example, the recent process that has come out, concerning which very little has been published, if anything—the Casale process. It is claimed for that process that they can make ammonia for 5 cents a pound.

And, if you please, in resisting the suggestion of Government operation, first I have no business to come here and argue with Senators of the United States on that subject, and I will not, but this thought—and I do not intend to predict to you what Congress will do. I once thought maybe it would do certain things here about Muscle Shoals, but I have learned something about that proposition. I suggest to you that if you wished to use the Casale process and they wanted a million dollars for entrance fee into this country and a cent a pound you would get that thing through Congress in about five years—just about five years.

Senator McNARY. As quick as that?

Senator HARRISON. You are speaking from experience?

Mr. WORTHINGTON. I am speaking from experience.

If Mr. Ford found out that was a good thing he would decide about paying a million dollars just about as quickly, and a little quicker, perhaps, than he would sign this contract, and it took him only 30 days.

The CHAIRMAN. I think it ought to be said there, in defense of my own bill——

Mr. WORTHINGTON. Do not understand that I am making any criticism of your bill.

The CHAIRMAN (continuing). That it would not take that board provided for in that bill, perhaps, any longer to make a decision than it would Mr. Ford. It would not have to go through Congress. It does not follow, under my bill, that if the Government took it that would have to go through Congress.

Mr. WORTHINGTON. I am not entering into any discussion with you about that at all. I am just calling your attention to this fact, Senator Norris, that unless there is a change here it will be a long time before you get your bill.

The CHAIRMAN. I think that is right. I think there is no doubt about that.

Mr. WORTHINGTON. Coming back to this ammonia problem—and I hope you Senators will bear with me a little, because I do not think it is understood——

The CHAIRMAN. I am sure we will be glad to hear you.

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Mr. WORTHINGTON. I don't believe this ammonia problem and its necessity in this country is understood. Just suppose you can make 5 cents a pound ammonia. Just take it during the war period and see what kind of bill you paid. During the war period of 1914–1918, inclusive, the importations of Chilean nitrates amounted to 5,081,578 pounds. The valuation at the Chilean port, plus $12.53 export tax here, plus $25 average war-time ocean freight, the total value of $371,508,000 that this country paid during the war period, 1914–1918. The average delivery at port would be $73.10 per ton, or 16 cents per pound, of ammonia.

At 5 cents a pound for ammonia the war bill would have been $103,908,000 against $371,508,000, or a saving in this single war material for this one war of $268,600,000.

Of course I know how usual it is to say, "Well, figures don't amount to anything," but that is a fact. If 5-cent ammonia had been available in the United States since 1867, the year in which we have the first record of the importation of Chilean nitrates into the United States, the country's nitrogen bill between 1867 and 1920 would have been $273,700,000 instead of $821,184,000. The country would have saved $547,484,000—a saving of more than $10,000,000 a year.

Well, I don't know of anybody in the United States that has had the courage to make a proposition or that has had the courage to propose to get into this problem except Mr. Henry Ford. Moreover, I do not know anybody in the United States that could be found to do it, or that has the money to do it. It is all very well, Senators, to talk about experts. Sometimes I have thought that we would be saved from them, but the man that goes and takes out a proposition of his own, with his own money, and displays that American initiative that has built up this country, that is the man that I would love to listen to as an expert, and I would like to ask you, even urge upon the committee, that you send for Mr. Swann.

The CHAIRMAN. Whom?

Mr. WORTHINGTON. Mr. Theodore Swann. I urge you to send for him and get him to tell this committee of his struggles in working out the phosphoric acid problem that he has had, and I have not any doubt but what you gentlemen who now think that you might possibly, to the welfare of the country, hasten into Government operation at Muscle Shoals will hesitate. He came very near failing two or three times, but he succeeded. Well, there is a very vast difference between that kind of expert testimony and the man that comes to this committee and tells you this process will do or that process will do, this process is obsolete, and a certain process is the best process. There is a vast difference between Mr. Swann's experience at Anniston, Ala., and testimony that he may give as compared with, for instance, your own laboratory experience at Arlington in the very same line.

Now, I think if you sent for Mr. Swann and got him to give his experience of what he has accomplished and show what he has made and what it means, and then if we might hope that the committee would have reason to lend Mr. Ford a little imagination, you could see what a problem he would attempt to work out to get the needed thing for soil food, namely, enough more ammonia, cheaper ammonia, at 5 cents a pound. I don't mind if I do violate confidence right in the presence of Mr. Mayo to tell this committee that he has shown that the thing he is interested in and the thing he has investigated and inquired about is not whether you could make ammonia at Muscle Shoals, but is it possible to make 5-cent ammonia, and any other attempt is a waste.

Take the ammonium sulphate production, the selling price of which normally runs right along with Chilean nitrates. Ammonium sulphate, 24 per cent ammonia, the cost is $3.50 per unit of ammonia, or 15 cents a pound. Sodium nitrate, 20 per cent ammonia, is selling at $2.80 per hundred pounds, which gives 14 cents a pound for ammonia.

Now, I have given you some figures here, and if the chairman and the committee do not object, I would like to have this sheet showing the importations put into the record.

The CHAIRMAN. All right. Give it to the reporter, and it will go right in with your testimony.

(The statement referred to is as follows:)

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Nitrate of soda imports from Chile to United States.

[Extract from hearing before the Committee on Agriculture and Forestry, United States Senate, Sixty-sixth Congress, second session on S. 3390.]

[Statistics from Bureau of Foreign and Domestic Commerce, Department of Commerce.]

Fiscal year—	Long tons.	Value.	Average value per 100 pounds.	Export duty.
1867	13,150.00	$503,624.20	$1.92	(1)
1868	8,230.00	282,785.00	1.54	(1)
1869	12,900.00	600,691.00	2.08	(1)
1870	13,900.00	752,604.00	2.42	(1)
1871	22,400.00	1,254,963.00	2.49	(1)
1872	16,000.00	934,118.00	2.61	(1)
1873	26,700.00	1,469,243.00	2.46	(1)
1874	27,700.00	1,338,141.00	2.16	(1)
1875	23,300.00	908,855.00	1.85	(1)
1876	23,100.00	1,055,357.00	2.04	(1)
Total		9,220,381.20		(1)
1877	24,300.00	1,324,299.00	2.44	(1)
1878	18,800.00	973,223.00	2.32	(1)
1879	34,100.00	1,348,880.00	1.76	$142,538.00
1880	30,400.00	1,830,396.00	2.69	380,912.00
1881	43,800.00	2,356,167.00	2.40	548,814.00
1882	82,300.00	3,911,610.00	2.12	1,031,219.00
1883	57,200.00	2,336,681.00	1.82	716,716.00
1884	54,000.00	1,983,378.00	1.64	676,620.00
1885	48,800.00	1,696,055.68	1.55	611,464.00
1886	45,100.00	1,681,824.14	1.67	565,103.00
Total		19,442,513.82		4,673,386.00
1887	76,800.00	2,614,162.00	1.52	962,304.00
1888	80,000.00	2,449,639.40	1.37	1,002,400.00
1889	67,500.00	2,275,993.00	1.51	845,775.00
1890	91,300.00	2,709,130.72	1.33	1,143,989.00
1891	98,091.67	2,929,759.78	1.34	1,229,087.3721
1892	105,341.47	2,976,818.00	1.26	1,319,928.6191
1893	93,436.55	3,063,012.00	1.46	1,170 759.9715
1894	88,079.00	2,785,048.00	1.42	1,103,629.87
1895	14,803.00	4,124,712.00	1.48	1,563,781.59
1896	127,557.00	3,870,724.00	1.35	1,598,289.21
Total		29,798,998.90		11,939,944.63
1897	83,331.00	2,640,389.00	1.42	1,044,137.43
1898	125,081.00	2,729,750.00	.68	1,567,234.93
1899	122,314.00	2,054,815.00	.75	1,532,594.42
1900	184,247.00	4,735,877.00	1.15	2,308,614.91
1901	203,609.00	5,776,596.00	1.27	2,551,220.77
1902	192,321.00	5,555,361.00	1.29	2,409,782.13
1903	252,084.00	7,737,405.00	1.37	3,158,612.52
1904	233,574.00	9,259,656.00	1.41	3,678,482.22
1905	282,229.00	9,083,396.00	1.53	3,536,329.37
1906	373,986.00	13,117,887.00	1.56	4,686,044.58
Total		63,302,022.00		26,473,083.28
1907	342,073.00	14,041,202.00	1.83	4,286,174.69
1908	330,090.00	12,546,611.00	1.69	4,135,027.70
1909	353,494.00	12,583,417.00	1.58	4,429,279.82
1910	550,495.00	16,874,682.00	1.37	6,897,702.35
1911	546,525.00	17,101,140.00	1.40	6,847,958.25
1912	481,739.00	15,431,892.00	1.43	6,035,189.67
1913	589,135.00	20,718,998.00	1.57	7,381,874.08
1914	594,049.00	17,950,786.00	1.42	7,067,533.97
1915	577,122.00	16,355,701.00	1.26	7,231,338.66
1916	1,071,728.00	32,129,397.00	1.35	13,428,751.84
Total		175,733,796.00		67,742,831.03
1917	1,261,659.00	44,231,240.00	1.57	15,808,587.27
1918	1,007,020.00	70,129,026.00	1.95	20,135,960.60
1919	1,345,679.00	68,229,548.00	2.27	16,873,887.87
Total		182,589,814.00		52,818,435.74
Grand total	13,313,673.59	480,087,147.92		163,647,680.6827

[1] None.

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NOTE.—The value given here is based on the value at the port in Chile, and does not include export duty paid to the Chilean Government, ocean freight, insurance, commissions, etc. Before 1914 freight from Chile to the United States was about $7.50 per ton; at the present time it is about $17.50. In 1879 an export duty was put on nitrate shipments from Chile and amounted to about $4.18 per long ton. In 1880 this duty was raised to $12.53 per long ton and has not been changed since that time. The export duty paid to the Chilean Government on all nitrate of soda coming to the United States up to July 1, 1919, would amount to $163,647,680.6827.

Value at Chilean port	$480,087,147.92
Export duty to July 1, 1919	163,647,680.68
	643,734,828.60
Ocean freight, insurance, commissions, etc., from 1867 to 1919	177,448,795.52
Total	821,183,624.12
Estimating the same 10-year increase in shipments of Chilean nitrate to the United States, our bill to Chile since 1867 will stand in 1928 (on the basis of nitrogen consumption doubling every 10 years)	578,860,821.06
Total	1,400,044,545.18

Mr. WORTHINGTON. Take the single thing of cottonseed meal. If you credit the phosphoric acid, potash in cottonseed meal, carrying about 8 per cent ammonia, and takes cottonseed meal selling at $45 per ton, and credit your phosphoric acid, and you get it down to $41.56 a ton for cottonseed meal. That is 26 cents a pound for ammonia. Why, there is no more horrible waste or criminal thing that you could do economically than to put the food of cottonseed meal under the cotton plant to make more cotton. And let us apply that. We use about 800,000 tons annually of cottonseed meal as fertilizer—just about. In 1914 I believe we used 800,000 tons. Why does the cotton farmer do it? Because he has no cheap ammonia to put in place of it. If he did, he would send part of that to Nebraska to feed their cattle, and to New England, as well as to export it.

The CHAIRMAN. When he uses it as a fertilizer he mixes it with something else, does he?

Mr. WORTHINGTON. No; sometimes he does and sometimes they use cottonseed meal just straight.

The CHAIRMAN. They do?

Mr. WORTHINGTON. Yes; the saving I may refer to a little later, if the committee would permit me, because it does present a most stirring proposition that you are using food to fertilize a cotton plant when you have got the nitrogen in the atmosphere, more than 30,000 tons on every acre, if you can get it out and put it into ammonia, say, at 5 cents a pound.

The CHAIRMAN. It is like burning corn for fuel in the West, is it not?

Mr. WORTHINGTON. It is quite as bad. Mr. Chairman, will you let me refer to that cottonseed meal again and get into the record some illustrating data on the subject?

The CHAIRMAN. All right, Mr. Worthington.

Mr. WORTHINGTON. Let us compare 15-cent ammonia against 5-cent ammonia just a little further, if the committee will be patient.

Take the case of a farmer applying 150 pounds of ammonia sulphate, for instance, per acre, and he gets an average increased yield of corn and cotton. The average increases were presented to the House committee by Doctor Whitney. One hundred and fifty pounds of ammonia sulphate is 36 pounds of ammonia. Thirty-six pounds of ammonia at 15 cents a pound is $5.40. You get an increase according to Doctor Whitney's statement, of 4 bushels of corn per acre. The cost of the additional corn would be $1.35 a bushel. If that farmer could get 5-cent ammonia, 36 pounds would cost $1.80, and the cost of the additional corn would have been 45 cents a bushel.

The CHAIRMAN. It is still too high.

Mr. WORTHINGTON. Well, I am sure there may be in the future, in the evolution of working out of this problem, the possibility that you may get ammonia for less than 5 cents. I think you will. But it will cost a bundle of money to do it, and rather bitter experience at times, I expect.

Take cotton. Assume an average increase due to fertilizer of 54 pounds per acre, although most cotton land in the South, in most of the States, will hardly produce any crops of cotton at all without fertilization, the cost of your additional cotton with 15-cent ammonia is 10 cents per pound of cotton. The cost of this additional cotton at 5 cents for ammonia is 3½ cents per pound of cotton

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We use, I believe, about 7,500,000 tons of fertilizer in this country annually in normal years. Keeping in mind the difference between the cost of ammonia at 15 cents a pound and the cost at 5 cents a pound, let us see what has happened in the consumption of commercial fertilizers in this country, say between 1913 and 1919, and let us see where the growth has occurred.

New Mexico has increased 650 per cent, South Dakota 328 per cent, and in the Western States, which they say are arid, the increase has run from 100 per cent in Colorado to 650 per cent in New Mexico, Michigan 78 per cent, Oregon 67 per cent; and the figures run along in the twenties down until you get through Massachusetts. And right there, there is a significant thing, that during the war, with the cost of fertilizer per ton mounting skyward, the consumption curve of New England and the Middle West went right along.

The CHAIRMAN. You mean the consumption of fertilizer?

Mr. WORTHINGTON. The consumption, the purchase curve went right along persistently, even in the face, Senator, of the cost increase of perhaps 300 per cent. I should say the cost increased at least three times. In South Carolina, however, he could not get it out of the cotton, and the consumption of South Carolina dropped more than one-half.

That illustrates the whole thing, and if you have worked this problem out it is merely a question of putting electricity to work on the farm as an agricultural laborer. That is all it is. We have put electricity, as I tried to suggest this morning, to work in nearly every industry in the country in a most wonderful way, except on the farm. Of course if the committee cannot grasp that Mr. Ford's imagination is aroused and his ambition fired by this, I don't think you will have got the Ford viewpoint at all.

The CHAIRMAN. I think the committee does grasp it. They get the idea, but the difficulty is that unless we can get Mr. Ford's viewpoint put into a contract we can not expect results after his death.

Mr. WORTHINGTON. You can not contract American industrial ambition. You can not translate that into a contract. That American initiative is something that can not be put into words and signed and nailed down at dollars per pound. That can not be done. I don't think, Senator, you will——

The CHAIRMAN. No; I get your idea exactly, I think, but, on the other hand, there is not anything in this proposal of Mr. Ford's that ties him down. He is all right. He is going to do the best he can. He is moved by the best of motives.

Mr. WORTHINGTON. Yes.

The CHAIRMAN. To all of which I agree, but you do not say, of course, that he is going to live beyond his allotted time, and that is where the thing falls down.

Mr. WORTHINGTON. It is just the expression of personal opinion. I would rather have Henry Ford untied at Muscle Shoals than most anyone I know tied.

The CHAIRMAN. Assume that to be true. Assume that everybody wanted to do that. Unless we can negotiate with God Almighty and have Him give an extension of life we can not have that worked out, even if both sides agreed to that.

Senator HARRELD. You might get Conan Doyle to do it.

Mr. WORTHINGTON. In regard to the 100-year period, the committee will concede one thing, I think, that if a business man like Mr. Ford felt it was absolutely impossible for him to do the thing in 50 years, that is just a matter for the committee to decide whether they will depart from what appears to be a very fixed policy as to time, or will make an exception in this case.

Mr. Chairman, there is one thing that has run through these discussions and hearings ever since 1916, and that is this, that with these new methods of producing fertilizer compounds we could hope to produce fertilizer and sell it to the farmers of the country for about one-half what they have been paying for fertilizer in normal years. The accomplishments in producing phosphoric acid by electric furnace methods seem to prove that. Our country or our Government has not been interested in this ammonia problem like other Governments, has not taken the interest in it, and, for instance, we may contrast what we have done with what the English did after the war. There is their research report, and here is a supplement. It might interest the committee to know that while it is generally understood that Japan has got the right to use all of the processes that have been carried to anything like a commercial stage for producing nitrogen by the air-fixation process, I understand that in the case of this Casale process, which promises to produce ammonia cheaper

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than any that have come out to date. Japan has already secured the right to use it and has paid a high price for it.

The CHAIRMAN. What can you tell us about the Casale process?

Mr. WORTHINGTON. It is a process requiring about the same power as the cyanamid process, but you don't have any coke or any lime or any of those steps of the cyanamid process; that through the production of hydrogen, using an electric cell, you get pure hydrogen.

The CHAIRMAN. That is one of the difficulties in the cyanamid process, is it not?

Mr. WORTHINGTON. I was just going to say that that is what they particularly claim is the excellent thing that they have accomplished. And that goes on, of course. You can go from pure hydrogen, and you can get nitrates of ammonia or ammonium sulphate or ammonium phosphate. I am sorry that what information I have on the subject as a layman I am compelled to tell the committee I can not divulge.

The CHAIRMAN. Is it a patented process?

Mr. WORTHINGTON. Oh, yes.

The CHAIRMAN. Who owns the patent?

Mr. WORTHINGTON. It is a company that has been formed in Switzerland, I believe.

The CHAIRMAN. It is patented in all countries, I suppose?

Mr. WORTHINGTON. Oh, yes. The Japanese have secured the right to use it. The Aluminum Co. of France, the French Aluminum Co., have acquired the right, and it is rather interesting right there that the Aluminum Co. of France should get it, since you, of course, have heard that the production of fertilizer as a by-product in connection with the aluminum industry might be looked for. The Swiss Government—or, I think, a Swiss company—is negotiating for the use of it in Switzerland, and a very interesting thing I was told was that Doctor Caro and Doctor Frank, of Germany—Doctor Caro and Doctor Frank, as you know, are the scientists that worked out the cyanamid process—have been trying to secure the Casale process rights for Germany.

The CHAIRMAN. Are they both Germans?

Mr. WORTHINGTON. They are both Germans.

The CHAIRMAN. I thought the process was first developed in Norway.

Mr. WORTHINGTON. No, sir. That is the arc process.

The CHAIRMAN. Oh, yes.

Mr. WORTHINGTON. Those two German scientists, Doctor Caro and Doctor Frank, developed the cyanamid process, and I understand that they have been negotiating for some time to get the right to use the Casale process in Germany, their difficulty being the German mark——

The CHAIRMAN. Is it known how much it will cheapen the operation?

Mr. WORTHINGTON. If it reduces it to 5 cents, it will reduce it two-thirds. Ammonia is not produced in this country——

The CHAIRMAN. That is, the ammonia would be produced for that.

Mr. WORTHINGTON. And, of course, to-day it costs about 15 cents to produce it. I believe that Major Burns reported that they might produce ammonia at nitrate plant No. 2 at 15 cents a pound, but he did not charge any interest in and he put the power at three-fourths of a mill per kilowatt. That is $4.90 per horsepower-year, which is pretty low. And then, perhaps there were other things that were left out. I don't think anybody claims that you can produce ammonia by any of these modern electric processes under 15 cents. Do you think so?

Mr. WALDO. No.

Mr. WORTHINGTON. No one that I know of.

The CHAIRMAN. While it might be a little diverting, you have mentioned the inventors of the cyanamid process, and I wonder are they in Germany now getting nitrates out of the air by the operation of a plant using the cyanamid process?

Mr. WORTHINGTON. I think I have the data on that. In connection with that question, it has been stated, of course, and insisted by some, that the cyanamid process is obsolete. Well, in some ways I expect that that statement is subject to doubt, and that when some who are perhaps accepted authorities insist that that process is obsolete they forget that it may be that some of its possibilities have never been worked out; and the committee will grant that there has been a great deal of confusion about the different kinds of processes. That is in the record. The only way to solve that confusion is to find out which is the cheaper; and you will have to go, like Mr. Swann has done.

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beyond the point of mere expert op'nions, and you will never know until you do it. But this information is at hand with regard to the cyanamid situation in Germany. About a year ago the representative of the Department of Commerce in Berlin, Mr. Howard W. Adams, reported that Germany was producing 600,000 tons of cyanamid annually.

The CHAIRMAN. And how much by the Haber process? Does the report give that? She is producing by the cyanamid process?

Mr. WORTHINGTON. Mr. Adams reports a capacity of 300,000 tons of nitrogen, a capacity of a million and a half tons of sulphate of ammonia.

The CHAIRMAN. By the Haber process?

Mr. WORTHINGTON. By the Haber process.

The CHAIRMAN. That is considerably more than they are getting by the cyanamid process?

Mr. WORTHINGTON. Oh, yes. I think there is more produced.

The CHAIRMAN. What power do they use? I understand they have to use coal.

Mr. WORTHINGTON. They do use coal. They have some water-power development in Germany.

The CHAIRMAN. Yes; I suppose they do have some.

Mr. WORTHINGTON. It is mostly lignite coal, and they insist that they can produce power with their lignite coal nearly as cheaply as we can make water power.

The CHAIRMAN. Do you know what their power costs?

Mr. WORTHINGTON. No, sir.

The CHAIRMAN. It would be interesting to know. I do not know why, without water power, Germany is doing the thing that we find almost impossible to do, with the cheapest power we can get in the way of water power, and if she is doing it why can't we? Is the process just the same?

Mr. WORTHINGTON. The cyanamid process is just the same as the one that you used at nitrate plant No. 2.

The CHAIRMAN. If it costs her as much for the fertilizer as it costs us if we were doing that, her products, when she produces them, instead of being under ours would be away above. It seems that there is something about it that has not been explained by anybody.

Mr. WORTHINGTON. I do not know that that would be satisfying, but I think I could make a suggestion to you to illustrate the case.

Before the war the United States Steel Corporation kept a committee of experts in Germany all the time, and the assistant to the president of the Steel Corporation told me that with the committee over there we could not find out what they were doing.

The CHAIRMAN. That would rather indicate that they had a process superior to ours—more economical. Now, I would like to find out whether or not that is a fact—if they have any process that we do not know about now.

Mr. WORTHINGTON. Well, Mr. Chairman, do you think we will ever get that kind of information until our Government takes some organized interest in this subject?

The CHAIRMAN. I am afraid not, Mr. Worthington, but I would like to know what the facts are now.

Mr. WORTHINGTON. Other countries are keeping right up with it, and they are showing the keenest interest in it, and we don't.

In connection with Germany's operations—and referring back to that thread of information, however it may have been doubted by some, it did persist through the hearings that with this development that we have already made, along with others that might be added at Muscle Shoals, you could make fertilizer at one-half what it costs. There is an example of the review and study by the English of this whole problem.

The CHAIRMAN. They are not making it, as I understand it.

Mr. WORTHINGTON. Oh, yes; they have a plant they are building in England.

The CHAIRMAN. What process?

Mr. WORTHINGTON. I think they are using the cyanamid process.

Mr. WALDO. Both.

Mr. WORTHINGTON. Both the cyanamid and Haber processes.

The CHAIRMAN. Is that since the war? They did not have any plant during the war, did they?

Mr. WORTHINGTON. They started it, Senator, during the war, and really had not progressed very far when the war ended, and they turned it over to Messrs. Brunner, Mond & Co. (Ltd.).

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The CHAIRMAN. They use coal for power, I presume?

Mr. WORTHINGTON. Oh, yes.

The CHAIRMAN. And are they making fertilizer?

Mr. WORTHINGTON. What production they have now I don't know.

Mr. WALDO. They are producing from six to seven thousand tons of nitrogen annually.

Mr. WORTHINGTON. They are producing six to seven thousand tons of nitrogen annually. This report says, though, Senator Norris, that the work, however, is being laid out so that this small nucleus may be quickly enlarged to 100 tons per day. That is nitrogen, and when you get to a capacity of 300 tons per day, or about 80,000 tons of nitrogen annually, that is twice the capacity of nitrate plant No. 2.

The CHAIRMAN. That is more than nitrate plant No. 2?

Mr. WORTHINGTON. Twice as much.

The CHAIRMAN. They have not built that.

Mr. WORTHINGTON. They are laying down the works to do it.

The CHAIRMAN. I understand nitrate plant No. 2 is the largest of its kind in the world.

Mr. WORTHINGTON. It is.

The CHAIRMAN. Can you tell us what the power costs to make this in Great Britain?

Mr. WORTHINGTON. No; I don't know.

The CHAIRMAN. Are we able to get the secret from Great Britain? She is one of our allies. I suppose she would give it to us freely, wouldn't she?

Mr. WORTHINGTON. I should think so. I have already suggested, in connection with this subject, to one of the officials in the Department of Commerce, that this country ought to set up a permanent nitrogen commission with plenty of money, of the ablest selection you could make, and they ought to keep up with the subject in other countries.

To go back again, Mr. Chairman, to what Dr. Caro said in 1919. In discussing Germany's capacity for nitrogen fixation, he reviewed the subject from the German standpoint, and he said that:

"Another thing we who fear that German national industry will be able to cope with foreign competition in view of high wages and high costs of combustibles can not be at present predicted, since the cost of coal, which in the future is sure to be one of the most important items of expense"—

Just right in line with your inquiry—

"can hardly discuss the lime nitrogen cyanamid industry on account of its unusually small consumption of coke will be in a very favorable situation. This will be particularly true when the construction market sinks to some half-way normal level, so that the capital cost of water-power development will be more reasonable."

He says this significant thing:

"Far more dangerous than competition of Chilean nitrate appears to be the possibility of competition of artificially fixed nitrogenous fertilizers produced in foreign countries. The largest of these foreign nitrogen plants is located in the United States, in Alabama. Its situation is most excellent."

He refers to the fact that Muscle Shoals is connected with——

The CHAIRMAN. Read what he says about Muscle Shoals. I am interested to know what foreigners say about it.

Mr. WORTHINGTON. He says, "It is connected with the ocean by means of the Tennessee River, which has been made navigable. It is situated at a source of almost constant water power amounting to 400,000 horsepower, and is right in the midst of the locality where all the raw materials of the lime nitrogen cyanamid industry are present in the highest purity and at the very lowest prices."

Now, this is the significant thing he says, according to my view:

"Nearby are the inexhaustible deposits of phosphate rock. A possibility therefore exists of producing cheaply ammonium phosphate containing 45 per cent water-soluble phosphoric acid and 20 per cent nitrogen."

Now, in that connection I have no doubt that Doctor Caro had in mind a cheap ammonia, even a cheaper ammonia than he can produce by his cyanamid process.

Senator NORBECK. Mr. Senator, there is another question I would like to ask this witness.

The CHAIRMAN. All right, Senator.

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Senator NORBECK. I would like to get clear on what part of the cost of nitrogen is really the power itself. We seem to rely on cheap fertilizer because we have cheap power.

The CHAIRMAN. Senator, that depends on the process a good deal.

Senator NORBECK. On the processes that are now in use.

The CHAIRMAN. All right. Can you give us that?

Mr. WORTHINGTON. Would you allow us to put that in the record and hand it to you?

Senator NORBECK. Certainly.

Mr. WORTHINGTON. Probably it would be more accurate.

NOTE.—The following estimates are taken from the figures submitted by the Ordnance Department before the House Committee on Military Affairs, April 19, 1920.

Estimated production cost of commercial cyanamid per ton, using steam power	$31.10
Cost of power used at 4 mills per kilowatt hour	11.23
Proportion of total cost represented by the cost of power, per cent	36.1

Senator HERRELD. Did I understand you to say that in England they have made a contract with a private company to develop the phosphate resources—I mean the nitrogen resources? Did I understand you to say that in England they had made a contract with a private concern to produce nitrates for the Government?

Mr. WORTHINGTON. Oh, yes. We will put the information you ask for in the record, but I am now answering you, Senator, that, as stated, the English have started development during the last stages of the war, and they were to use the synthetic process at a factory at Billingham, England, designed to manufacture about 60,000 tons of ammonium nitrate annually for war purposes. This was commenced by the Ministry of Munitions early in 1918, but at the time of the armistice was only very little advanced. It has since been taken over from the Government by Messrs. Brunner, Mond & Co. (Ltd.), and is being redesigned to manufacture peace products, chiefly fertilizers, and the rest of it we will put in as a full story.

Senator HERRELD. That is all I wanted to know. I just wanted to know if they were working on it through private industry.

BRITISH DEVELOPMENTS IN NITROGEN FIXATON.

[Statistical supplement to the final report of Nitrogen Products Committee of the Ministry of Munitions, p. 21.]

The synthetic ammonia factory at Billingham, designed to manufacture about 60,000 tons of ammonium nitrate annually for war purposes, was commenced by the Ministry of Munitions early in 1918, but at the time of the armistice was only very little advanced. It has since been taken over from the Government by Messrs. Brunner, Mond & Co. (Ltd.), and is being redesigned to manufacture peace products, chiefly fertilizers. The subsidiary company they have promoted, Synthetic Ammonia & Nitrates (Ltd.), which will have a capital of £5,000,000, is at present concentrating upon designs for an initial plant to produce 25 tons of ammonia per day, or about 6,000 to 7,000 tons of nitrogen annually. Their works are, however, being laid out so that this small nucleus installation may be quickly enlarged to 100 tons per day, and afterwards to a maximum capacity of 300 tons per day, or about 80,000 tons of nitrogen annually. The original Government site of 260 acres is being increased to about 1,000 acres in all, and two ship berths on the River Tees have been acquired. This increased accommodation has been found necessary in order to give ample room for the development of the whole scheme, which includes the manufacture of a number of by-products. There is also to be an oxidation plant of a capacity of 10,000 to 12,000 tons of nitric acid annually.

A British company, Cumberland Coal Power & Chemicals (Ltd.), has also been formed to erect works in England to operate the Claude process for the manufacture of synthetic ammonia. Information to hand states that a full size commercial ammonia unit, working at a thousand atmospheres, is now running satisfactorily in France, producing at the rate of 5 tons of ammonia per day.

The British Cyanides Co. are continuing at Birmingham their large scale experiments on fixation of nitrogen by the barium process, employing fuel-heated furnaces. Though these experiments have been partially successful, final conclusions as to the ultimate possibilities of the process have not yet been reached.

The works erected at Dagenham by the Nitrogen Products Co. to manufacture ammonium nitrate during the war period from cyanamide by the Ostwald process are now closed.

Mr. WORTHINGTON. It is rather interesting to know that Germany, with a population of 65,000,000 has 8,830 tons of nitrogen per million of population, while the United States has 1,480,000 tons capacity for producing nitrogen.

Senator HARRELD. Per million population?

Mr. WORTHINGTON. Germany has 8,830 tons per million of population against our capacity to produce 1,480,000 tons per million of population. That answers the question how can Germany feed by their own crop production nearly 65,000,000 people.

Senator HARRELD. Now, reverting to that statement that England has given a contract to make nitrates or turned over the nitrate business to private organizations, are there any of the governments producing nitrates as a government project at the present time?

Mr. WORTHINGTON. None that I know of solely under government direction and organization.

The CHAIRMAN. Is not Germany?

Mr. WORTHINGTON. I don't think that Germany is. Germany has an organization that is part commercial. Am I right about that?

Major BURNS. That is as I understand the German system. It is a Government subsidy in the production of nitrogen.

Mr. WORTHINGTON. Yes, sir. In France I am sure that the operations are all under private enterprise, and in Japan that is so, too. I think that, perhaps, the Italian Government has helped the industry in Italy. I don't know how much.

There is one phase of it. I don't know that it could be considered as favoring the acceptance of Mr. Ford's offer at all, but it seems to me it is one phase of this Muscle Shoals case that is overlooked, and that is the increased taxable value of property that will be created by this water-power development and its application. You take North Carolina as an example. It was one of the poorest States after the Civil War of all of the Southern States, and North Carolina stands eighth now, as of the fiscal year 1920, as an internal revenue taxpayer. She pays more Federal taxes than any New England State except Massachusetts. She pays more taxes than Missouri, more than Indiana, and more taxes than Texas. She pays more taxes than New Jersey. She pays more taxes than Minnesota.

The CHAIRMAN. You are speaking of Federal taxes now?

Mr. WORTHINGTON. Federal taxes.

The CHAIRMAN. Internal revenue?

Mr. WORTHINGTON. Yes, sir. Now, let us see what the explanation is. Of course, the first thought is tobacco, but when you investigate the matter you find that North Carolina has about 300,000 horsepower developed. It is stated here as 298,900 horsepower. South Carolina has 140,400 horsepower; Georgia, 129,400 horsepower; and Alabama, 92,000; Tennessee, 112,700; and you have got a total in that group of five southern States of 773,400 horsepower.

Senator HARRELD. Since Government taxes are based on profits, that might be an indication of a good deal of diversified production down there, or it might be an indication of profiteering, might it not?

Mr. WORTHINGTON. In any event, I should say it was an incident of the Government getting some money out of profiteers, and they do not usually do that.

Senator HARRELD. We are trying to fix Mr. Ford so that his profits will not be large and so the taxes will not be there.

Mr. WORTHINGTON. In any event, when you take wasting water and put it to work, you will be doing a good thing for the country.

Senator HARRELD. Yes; I was just speaking in a sarcastic vein.

Mr. WORTHINGTON. You gentlemen, in considering this, please bear in mind in the last 25 years there has only been 773,400 horsepower developed in those five States. There is one thing that will occur to anyone considering the development of water power in those five States, and what has happened at Niagara Falls in about 25 years, about 700,000 horsepower, that this Muscle Shoals project is too big for anybody except the Government and somebody as big as Henry Ford. Nobody of small means is capable of working it out, and if you gentlemen had 25 years back been considering those waterpowers in those five States you would not have got anybody to undertake to develop them and commence paying you on the cost of the development in six years. And so at Niagara Falls, I could not have nailed anybody down in a contract to do that.

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There is one phase of this case, Mr. Chairman, whatever you do with the Ford offer, we very much wish to get you and the committee to help us about.

The trouble about the Tennessee River case, since this power proposition at Muscle Shoals has been considered, has been to get surveys made. It took us nearly seven years, I think it was, to get a complete detailed survey of these two dams and their overflow lands at Muscle Shoals.

The CHAIRMAN. Well, I might suggest right there that if you will help us pass my bill, it provides for a complete survey of the Tennessee River and all its tributaries.

Mr. WORTHINGTON. I will do that, perhaps, if you might guarantee this little matter of mine; but you have asked me for such a large job as against a rather small favor that I hope you won't raise the point. But let us urge upon you that in the interest of the Government, if you do not let Mr. Ford have this, have appropriation made in the present rivers and harbors bill to survey these upper powers. You control them. No survey made by any company or any engineer except your own Engineer Corps will be accepted.

The CHAIRMAN. The rivers and harbors bill has not been used for the purpose of coordination in development. It is looking after navigation exclusively. Now, while navigation on the Tennessee River is of considerable importance it is a minor thing as compared with the power.

Mr. WORTHINGTON. Well, sir, Senator Norris, we made a good hard fight in 1920 and we got into the rivers and harbors act authority for the survey of the Tennessee River and its tributaries in North Carolina, Tennessee, Alabama, and Kentucky—a coordinated survey, complete, and we have never been able to progress. It is not nearly completed. It will cost a very considerable sum of money; but if it could be completed, and promptly, we perhaps might get some other people to build some dams on these upper streams. It is impossible, Mr. Chairman, to get anything done until the surveys are made, and it requires surveys that are detailed—the height of the dam, its length, and also such tests and foundations as will enable the United States engineers to say, "Yes; the dam may be built."

The CHAIRMAN. Why, sure; so they can take definite action on it.

Mr. WORTHINGTON. Nobody can go and build any dams on the upper Tennessee River. I have been told that the Aluminum Co. of America spent a very large sum of money in making an exhaustive survey of the Little Tennessee. There are some very attractive powers on the tributaries of the upper Tennessee River, but we can not do anything with them unless the United States Government will have them surveyed, and maybe then we can get somebody to build them; and I suggest to you——

The CHAIRMAN. Often these reservoirs, with their dams, will develop power as well as water, but I suppose there will be some that will probably be purely reservoir propositions, and private parties can not do that. You can not expect them to do it, because if you have a dam at one place and I have it at another, and you hold back the water, I get as much benefit as you do. The Government is the one that ought to do that and then make everybody contribute.

Mr. WORTHINGTON. But, taking the history of the Tennessee River for nearly a hundred years, it is vastly more important—and I am sure you won't disagree with that view—than even if some little navigation improvement on the Tennessee River had to wait, it is more important that the money be spent now to determine by detailed surveys what the Government owns, controls, and has there.

I don't believe, Mr. Chairman, that I have anything else to furnish you with.

Senator HEFLIN. Mr. Worthington, don't you believe if the Government should take over this project, the interests about in the country that oppose using it for the purpose of making fertilizer would delay the completion of it for years and years and years?

Mr. WORTHINGTON. Well, I don't know what they would do. Of course, it is known that it has been delayed. I don't know what will happen in the future, Senator.

Senator HEFLIN. Well, don't you think, though, they would use their influence to prevent the completion of——

Mr. WORTHINGTON. Judged by the past I would say that would be expected.

Senator HEFLIN. Why do you suppose the fertilizer trust is opposing the Ford bid to-day?

Mr. WORTHINGTON. Well, they know their business so much better than I do, suppose you send to them and ask them.

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Senator HEFLIN. You think they do want the price of fertilizer cut in half? Don't you suppose that has some influence on them.

Mr. WORTHINGTON. Well, Senator, as I am here giving facts in support of Mr. Ford's offer, I don't think I would like to criticize any of these people about anything.

Senator HEFLIN. You just want your proposition to stand on its own bottom.

Mr. WORTHINGTON. If it can not stand up and be counted, why, it will have to be counted down, I suppose.

Senator HEFLIN. Some one asked you why you thought we ought ot make an exception in this case in granting Mr. Ford this hundred year lease. I did not catch your answer.

Mr. WORTHINGTON. First, the magnitude of the undertaking, the very large investment he must make in order to work this proposition out, and in order to be able to pay the United States 4 per cent on the cost of these dams, I think he is entitled to it. And then again there is another thing. I can not at all agree that the 50 years in your present power act is a correct period of time. I think you compromised between the different contending views on the subject and you struck on 50 years. I think you will find that Canada now is probably making engagements as long as 99 years.

The CHAIRMAN. She has probably a larger governmental control than we have, however.

Mr. WORTHINGTON. In that connection, I would like to detain the committee, if I may.

Senator HEFLIN. Before you get away from that, don't you feel also that because Mr. Ford is going to manufacture fertilizers on a large scale, and be able to supply fertilizers in abundance to the farmers of the country at a low price, that should be an inducement on the part of the Government to make an exception in this case and to get away from the old rule?

Mr. WORTHINGTON. I think so, and I think the reason the exception should be made is that it is an exceptional case. It is not on all fours with others.

The CHAIRMAN. Well, while you are on that, just tell the committee wherein this proposition provides that you will make fertilizer so much cheaper than anybody else makes it and wherein it provides that Mr. Ford shall make the large investment that you say he will have to make. I would like to have it pointed out.

Mr. WORTHINGTON. In regard to Mr. Ford's investment there, I should like to suggest—I am not speaking for him or committing him in any way. I am not authorized to do so—in my associations with Mr. Ford I have concluded that perhaps he feels that he will have to spend as much money as the United States is going to spend. How he can ever work it out without a very large expenditure I don't know, but I would feel, if I were sitting on a board of directors and passing on Mr. Ford's offer, I would have to concede that as he is entering into a new field of investment and discovery, I would leave it to him for the reason that if he fails, if the power is as valuable for the United States to own and run you will not have lost it.

The CHAIRMAN. Now, that is the idea. In this proposition we have left up to him practically as to how much he shall spend, how cheaply he will be able to make fertilizer, and, to a great extent, how much he will be able to make. The only thing I object to is that we may leave it all to him for 75, 80, or 90 years after he is dead, and if we are going to do that we ought to put it into the contract as to the production of fertilizer cheaper, and as to the amount of the investment, and so on. If you depend on him, which you do, practically, then you ought to limit the proposition to his lifetime, and the next man who comes along, we will see whether he is as good a man as Mr. Ford before we trust him, and if we can not trust him we will not give it to him, but will look for some one else. There will be others, I suppose, after he is dead.

Mr. WORTHINGTON. Well, they don't grow on the limbs of trees.

The CHAIRMAN. Well, they don't; but he is not the only man in the country that is good, although he may be one of the best of them.

Mr. WORTHINGTON. If it had not been for him, Mr. Chairman, the poor man would never have seen an automobile for $350.

The CHAIRMAN. I think that is right, Senator, although they are not cheap enough for me to buy, even a Ford. On the other hand, while I would not charge this up against Mr. Ford, since he kept the price down, and I think is entitled to a lot of credit, I sometimes wonder whether he did not do a great deal of damage to humanity when he got them all to buying Fords and other cars. I just wonder if the price of cars was up beyond the reach of anybody

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but millionaires, whether we would not be better off than to have everybody going in debt to buy a car?

Mr. WORTHINGTON. The people of this country don't want to be saved from the damage that Mr. Ford will do them at Muscle Shoals. You may protect him against his development of Muscle Shoals, but, nevertheless, I believe this is one time they don't want to be saved.

Senator HEFLIN. The Fertilizer Trust does not want him in competition with them.

Mr. WORTHINGTON. I should say in regard to the production of fertilizer, I am not going into a lengthy discussion of that, because I don't think we would ever accomplish anything if we did, but if you will extend your kindness for just a moment, I would like to call your attention to one phase of this that has been misunderstood.

It has been suggested that Mr. Ford was trying to get this nitrate plant for a little or nothing, promised to make just a little fertilizer, and that he was going to run away with the rest of the power for his own selfish ends. Why, that is very foolish and it is a joke on us, too, in this country. Mr. Ford can get power across the river at Windsor, where he has a large plant already. Up to 1920, I believe, or up to 1917, say, Canada, while we were discussing this subject 10 years previous to that, had developed about a million horsepower, and we had developed none in our navigable streams, and then we find that Queenstown has a development of 600,000 horsepower, and that power from the power plant of the power commission of Ontario is going to Windsor. He can get power there and accomplish all of these evil purposes if he wants to, all of these subtle purposes of Mr. Ford to get Muscle Shoals to do these things so harmful to the welfare of the country, as some one has suggested, he could do right at home.

Senator NORBECK. I agree with you. I don't think——

Mr. WORTHINGTON (interposing). Let me read to the committee here an advertisement cut out of this morning's Washington Post, an offer of 3,500,000 of 8 per cent cumulative dividend stock with a 40 per cent bonus of common stock of the Aluminum Alloy Steel Corporation (Ltd.) They are going to establish a plant that they propose to have making alloy steels in Canada, and they are going to use power from the Ontario Power Co.'s developments.

Well, I don't know what you will do with Mr. Ford's offer, but surely we have come to the point when sensible national pride demands that we do something in this country. It was found wise, or President Taft decided it was wise, to veto the permit passed by Congress to build Lock 18, and the nitrogen-fixation industry instead of being established at Montgomery, Ala., as it would have been, went to Canada.

In the course of this advertisement it will be found that this company states that they have the cheapest raw materials, transportation facilities, that they have very cheap ore and very cheap coke, when, as a matter of fact, Mr. Chairman, the ore that will be supplied at this alloy steel plant, if it is established, right over in Canada, and not far from Detroit, will cost twice as much per unit as Mr. Ford can get ore for at Muscle Shoals, and the coke will be nearly half again as much. I hope you will agree with one thought, that we ought to make a start in this country to catch up with Canada before she gets too far ahead, and before we suffer any more national humiliation on account of our getting in a rut on this power question.

The CHAIRMAN. Right on that point, there was given to me during these hearings a report by some electrical engineers of this country who were selected to compare the privately owned power in the United States with the publicly owned power over in Canada.

Mr. WORTHINGTON. Mr. Murray's report?

The CHAIRMAN. Yes. I read considerable of it. It seems to me they started out with the proposition that they were going to prove that publicly owned power costs the most, and they proved it, and they were arguing that way all the way through, and if that be true, the thing to do is not for Canada to get ahead, because her power is so much more expensive than ours. It is Government controlled, and ours is privately controlled. They could come over here where these engineers argue they can get so much cheaper power. Therefore, your argument that Canada will get ahead of us must fall before this magnificent report of a lot of millionaire power producers here that selected these men to make that kind of a report.

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Mr. WORTHINGTON. I have been talking about power development in the United States since 1910. As far as talk is concerned, I am ready to quit. I think it is time to do something.

The CHAIRMAN. According to this, we have done much better than they have in Canada, where the Government does it, but now you say we have to hurry up or Canada will get so far ahead of us we will never catch her.

Mr. WORTHINGTON. We have not been developing any.

The CHAIRMAN. I am not saying that we have. In fact I did not believe what these fellows said, and I am more convinced now since I have listened to you, as eminent an engineer as you are. You have convinced me that that report is no good.

Mr. WORTHINGTON. The Murray report?

The CHAIRMAN. But they were demonstrating or comparing private water-power development in the United States with Government development in Canada, and they demonstrated that it was cheaper over here because it was privately owned, and that Canada was way behind because it was Government owned.

Mr. WORTHINGTON. You have paid me a very fine compliment, Mr. Chairman, but I did not tell you I agreed with Mr. Murray's report.

The CHAIRMAN. It does not make any difference. I am glad that you do not. But you have been quoting from it somewhat.

Mr. WORTHINGTON. I am obliged to.

The CHAIRMAN. I think you have demonstrated what I believed to be true by reading this report itself, that it was intended to bring out just exactly what it did bring out; you have shown that over in Canada they are ahead of us in this water-power development.

Mr. WORTHINGTON. About 2,000,000 horsepower.

The CHAIRMAN. If that report showed anything, it showed the opposite.

Mr. WORTHINGTON. About 2,000,000 horsepower.

The CHAIRMAN. We are very much obliged to you, Mr. Worthington, for giving us a great deal of information.

The committee will take a recess until 2 o'clock.

(Whereupon, at 1 o'clock p. m. a recess was taken until 2 o'clock p. m.)

AFTER RECESS.

The committee reconvened at 2 o'clock p. m.

STATEMENT OF MR. J. W. WORTHINGTON—Resumed.

The CHAIRMAN. During the recess, Mr. Worthington, I have had my attention called to the fact that there is a municipally owned water power right down in that vicinity, at Athens. Do you happen to be familiar with that?

Mr. WORTHINGTON. I know that there is a municipal plant there.

The CHAIRMAN. They own the power. Do you know how much the power is?

Mr. WORTHINGTON. No, sir; I do not.

The CHAIRMAN. Nor at what they are able to supply the customers with light?

Mr. WORTHINGTON. I do not know. I know that they operate their own plant municipally in the town of Athens, but I do not know any of the details.

The CHAIRMAN. Do you know, Mr. Waldo?

Mr. WALDO. No, sir; I do not.

Mr. WORTHINGTON. I think we could get you any information you wish on that.

The CHAIRMAN. No; I don't think that is necessary. Of course, it is only indirectly that it bears upon the question that we have been discussing.

Mr. WORTHINGTON. Mr. Chairman, there is nothing that I care to consume your time with further. Of course, I am at your disposal. As suggested this morning, however, we thought we would add one other insertion on the subject of ammonia and its cost.

The CHAIRMAN. Yes.

Mr. WORTHINGTON. We think that further information on the subject will be interesting, and we will put that in with the other.

The CHAIRMAN. All right; give it to the reporter. Is there anything else that you have to say?

Mr. WORTHINGTON. No, sir.

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FIVE-CENT AMMONIA COMPARED WITH NITRATE OF SODA AT PRESENT PRICES.

The United States normally imports about 500,000 tons of Chilean nitrate, containing 20 per cent or, in the total, 100,000 tons of ammonia.

The cost of this nitrate at port is about $60 per ton, or 15 cents per pound of ammonia. It represents at this price a total outlay of $30,000,000 annually.

Produce this at a cost of 5 cents per pound and there results a saving of 10 cents per pound, or $200 per ton of ammonia, which on 100,000 tons of ammonia is an annual saving of $20,000,000.

* * * * * * *

FIVE-CENT AMMONIA COMPARED WITH SULPHATE OF AMMONIA AT PRESENT PRICES.

A fair average estimate of the consumption of sulprate of ammonia in the United States is 300,000 tons annually, containing 24 per cent, or, in the total, 72,000 tons of ammonia.

This sells at $2.80 per unit of ammonia, or 14 cents per pound of ammonia. If ammonia can be had for 5 cents per pound, the saving is 9 cents per pound, or $180 per ton of ammonia, which on 72,000 tons of ammonia is an annual saving of $12,960,000.

* * * * * * *

FIVE-CENT AMMONIA COMPARED WITH COTTONSEED MEAL AT PRESENT PRICES.

Buying cottonseed meal at $35 per ton, with due allowance for its phosphoric acid and potash content, is buying ammonia at 20 cents per pound. If ammonia can be had for 5 cents per pound, the saving is 15 cents per pound of ammonia.

The united States uses 800,000 tons of cottonseed meal for fertilizer purposes. This meal contains about 8 per cent, or, in the total, 64,000 tons of ammonia.

A saving of 15 cents per pound, or $300 per ton, on ammonia, which on 64,000 tons of ammonia amounts to an annual saving of $19,200,000.

* * * * * * *

SUMMARY.

If ammonia could be had for 5 cents per pound in the following fertilizers, the annual saving to the country would be as follows:

500,000 tons nitrate of soda	$20,000,000
300,000 tons sulphate of ammonia	12,960,000
800,000 tons cottonseed meal	19,200,000
Total	52,160,000

The CHAIRMAN. Are there any further representatives of Mr. Ford to be heard to-day?

Mr. WORTHINGTON. No, sir.

The CHAIRMAN. We will adjourn, then, until to-morrow at 10.30 o'clock.

Mr. WORTHINGTON. We will be subject to your demands, of course.

The CHAIRMAN. Yes.

To-morrow morning, at 10.30, we will have a representative of the Agricultural Department here.

(Whereupon, at 2.15 o'clock p. m., the committee adjourned until Saturday, May 6, 1922, at 10.30 o'clock a. m.)

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MUSCLE SHOALS.

SATURDAY, MAY 6, 1922.

UNITED STATES SENATE,
COMMITTEE ON AGRICULTURE AND FORESTRY,
Washington, D. C.

The committee met, pursuant to adjournment, at 10.30 o'clock, a. m., in the room of the Commerce Committee of the Senate, United States Capitol, Senator George W. Norris (presiding).

Present: Senators Norris (chairman), McKinley, Harreld, Kendrick, Harrison, and Heflin.

STATEMENT OF MR. J. W. WORTHINGTON—Resumed.

The CHAIRMAN. Mr. Worthington, when you were on the stand the other day, I omitted to ask you some questions, and that is the reason I have asked you to take the stand again.

Mr. WORTHINGTON. Yes, sir.

The CHAIRMAN. Mr. Worthington, the lease under the Ford proposition——

Mr. WORTHINGTON. What section is that, Senator?

The CHAIRMAN. I do not have the section in mind, but I think you need not refer to it.

Mr. WORTHINGTON. All right.

The CHAIRMAN. If you wait until I finish the question.

Mr. WORTHINGTON. All right.

The CHAIRMAN. The lease for 100 years commenced to run as to Dam No. 2 from the time the dam is completed?

Mr. WORTHINGTON. Yes; from the time the first 100,000 horsepower is ready.

The CHAIRMAN. And the lease of Dam No. 3 commenced to run from the time that dam is completed.

Mr. WORTHINGTON. Yes; from the time the first 80,000 horsepower is ready.

The CHAIRMAN. It is estimated that three years will elapse between the completion of Dam No. 2 and the completion of Dam No. 3.

Mr. WORTHINGTON. Well, I could not question that such an estimate has been made by some.

The CHAIRMAN. Well, if it is different, we will be glad to have your estimate.

Mr. WORTHINGTON. But that is not the plan that Mr. Ford has evolved.

The CHAIRMAN. It is not?

Mr. WORTHINGTON. Oh, no.

The CHAIRMAN. What is his plan?

Mr. WORTHINGTON. According to our discussion the plan is to go forward with that dam (No. 3), certainly, within a year's time and probably complete them both within a short time of each other.

Senator HARRISON. I understood Mr. Mayo to say a year and a half. I may be confused about that.

The CHAIRMAN. I think Mr. Mayo said that they would be able to complete Dam No. 2 with two years, or perhaps within a year and a half, as I remember his testimony. The point I wanted to bring out was that in Mr. Ford's offer the leases for the dams do not commence at the same time; but they each run for the same length of time. Would Mr. Ford be willing to modify his offer so that the leases would expire at the same time?

Mr. WORTHINGTON. And begin at the same time?

The CHAIRMAN. Begin at the same time and expire at the same time? That would mean that the lease on Dam No. 3 would have a little less than a

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hundred years to run? In other words, it seemed to me that when these leases expire, at least in the interest of the Government, they ought to expire at the same time.

Mr. WORTHINGTON. That is a reasonable thing.

The CHAIRMAN. Otherwise there might be some great difficulties involved.

Mr. WORTHINGTON. Yes.

The CHAIRMAN. On account of the fact that the leases would have a difference in time?

Mr. WORTHINGTON. Yes. Mr. Mayo is more expressly authorized to answer such a question, but I feel certain that your suggestion can be worked out. He is still in town and I will have him advise you to-day about it.

The CHAIRMAN. Well, you see the point I am getting at, Mr. Worthington?

Mr. WORTHINGTON. Oh, yes; I think you are right in your suggestion, that they ought to expire at the same time.

Mr. HARRISON. There might be a difference of at least three years.

Mr. WORTHINGTON. Yes.

Mr. HARRISON. Or a year and a half.

The CHAIRMAN. The plans of the Government engineers indicated that they expected that three years would elapse. In other words, they do not expect to finish Dam No. 3 until after they have finished Dam No. 2, so that they can use the machinery and equipment they have at Dam No. 2.

Mr. WORTHINGTON. Mr. Ford and Mr. Mayo have a different plan from that.

The CHAIRMAN. I understand they have.

Mr. WORTHINGTON. I see the point you make. I never thought of it before, but I am quite sure it is quite reasonable.

The CHAIRMAN. There might be conditions existing at the expiration of this lease that would make it extremely important; in other words, if the Government at that time wanted to lease to somebody else, or wanted to take it over, the fact that they could not get possession of one dam might mean very serious difficulty.

Mr. WORTHINGTON. I have every confidence that it could be arranged.

Senator HEFLIN. I think the Chairman's suggestion is a good one.

Senator HARRISON. The whole thing should expire at once.

Mr. WORTHINGTON. Oh, yes. I will confer with Mr. Mayo on that.

Senator HARRISON. Yes.

Mr. WORTHINGTON. And ask him to see you to-day.

The CHAIRMAN. There is another question that I want to ask you. Have you the offer there before you?

Mr. WORTHINGTON. Yes, sir.

The CHAIRMAN. It is amended paragraph 15.

Mr. WORTHINGTON. Yes, sir.

The CHAIRMAN. Originally paragraph 14.

Mr. WORTHINGTON. Yes, sir.

The CHAIRMAN. That is the agreement on the part of Mr. Ford to operate nitrate plant No. 2 at approximately its capacity.

Mr. WORTHINGTON. Yes, sir.

The CHAIRMAN. Did you hear the testimony of Mr. Hammitt?

Mr. WORTHINGTON. No, sir.

The CHAIRMAN. Did you read his testimony?

Mr. WORTHINGTON. No, sir. I heard some mention of it at our house, but I really do not know anything about it. May I ask what the point is?

The CHAIRMAN. I will read you this:

"The company agrees to operate nitrate plant No. 2, using the most economical source of power at the approximate present annual capacity of its machinery and equipment in the production of nitrogen and other commercial fertilizers (said capacity being equal to approximately 110,000 tons of ammonium nitrate per annum)," etc.

Mr. WORTHINGTON. Yes.

The CHAIRMAN. It was Mr. Hammitt's opinion that the words in brackets there, as follows: "said capacity being equal to approximately 110,000 tons of ammonium nitrate per annum," were misleading, that the term "ammonium nitrate" was not a proper way to express the capacity of the plant, and that it would not necessarily follow that in making fertilizers in times of peace we would get fertilizer equal to the capacity of the plant. That is the way I understood his testimony.

Mr. WORTHINGTON. Well, I did not hear his testimony, and I have not read it, but I would say that according to your version of it I should not agree with him.

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The CHAIRMAN. Well, I am not saying that I agree with him, but it raised a doubt in my mind.

Mr. WORTHINGTON. All I could say is that there had to be some minimum expressed in making this offer, because if none had been one would have been asked for, of course. The most reasonable and logical expression of a minimum was the capacity of the plant as designed and operated.

The CHAIRMAN. I think the committee understood—I know I did, and nobody seemed to have any different opinion about it—that this language used was, in effect, a promise, an agreement, to operate the plant at approximately its capacity.

Mr. WORTHINGTON. Precisely, sir; no other intention.

The CHAIRMAN. Do you understand that to mean now that we would get a fertilizer for the farmer equal in amount to the capacity of that plant?

Mr. WORTHINGTON. Oh, indeed.

The CHAIRMAN. Mr. Hammitt, it seemed to me, conveyed the impression that even if he did comply with this proposition, to wit, to produce annually 110,000 tons of ammonium nitrate, it would not follow from that that we would have the equivalent of the fertilizer that could be made from 110,000 tons of ammonium nitrate.

Mr. WORTHINGTON. Or some other commercial fertilizer equivalent to that.

The CHAIRMAN. Yes.

Mr. WORTHINGTON. Why, undoubtedly; that is the very full intention of that proposal.

The CHAIRMAN. After we get that ammonium nitrate, what is necessary from that period on in order to get fertilizer, and is it an expensive proposition?

Mr. WORTHINGTON. Yes; it is expensive to go from—not ammonium nitrate, but it is to go from cyanamide to ammonium sulphate. I would like to see if I could clarify right here the trouble which has run all through these discussions, and that is this, that it does not mean that that plants' capacity will be applied to cyanamide. It does not necessarily mean at all that its capacity of 110,000 tons of ammonium nitrate will be the thing done. The members of this committee, those who were at the hearings in 1916, will recall that Mr. Washburn very clearly explained what would be done, and he himself, though the leading authority in this country, and as good as any in any country, on the subject, never claimed that the development there would be used to make cyanamide.

The CHAIRMAN. As distinguished from the ammonium nitrate, what is cyanamide?

Mr. WORTHINGTON. I have understood that Mr. Hammitt expressly warned this committee that there was no market for the capacity of this plant in cyanamide—well, I have not understood that anyone claimed that there was such a market or that anyone has represented that the plant would be run to its capacity in cyanamide production, and it is not known yet, as I think has been explained, and if it has not been explained here Major Burns can make it very clear, that there are some difficulties—physical difficulties—connected with ammonium nitrate that have to be solved before it ever proves a successful nitrogen fertilizer.

Am I not correct about that, Major Burns?

Major BURNS. Absolutely.

Mr. WORTHINGTON. That only furnishes an example of what this field of research offers—indeed, enforces—if you work out this problem of ammonia; but, Mr. Chairman, the production of phosphoric acid by electric-furnace processes has been established commercially and definitely. You only have to find, if you please, what is the cheapest process that will produce ammonia. If you can find a process that will produce ammonia for 5 cents a pound at the plants then you will have solved the fertilizer problem of this country.

With that statement I would like to ask you, Mr. Chairman, do I clarify it at all?

The CHAIRMAN. Well, I confess I am in some doubt about it yet. I might explain to you that it is the idea of the committee that in time of peace we want it possible—and, of course, we can not expect the impossible; if the scientific men say it is impossible we have to give it up—but our dream and our hope is that in time of peace this plant should be operated to its reasonable capacity in the production of a commercial fertilizer that can be used by the farmer. If any members of the committee have a different idea of what we are trying to reach I wish they would correct me now.

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Senator KENDRICK. I have this additional idea, Mr. Chairman, although that is exactly my notion so far as it goes, that the primary purpose during times of peace is to supply the farmers with as cheap fertilizer as can be had, but there is behind it the secondary question of the necessity of keeping this plant going in order to be ready in case of war.

The CHAIRMAN. Oh, yes; we want that; but, Senator, as I understand it, we could keep the plant ready to be used in time of war, without running it during peace time at all.

Senator KENDRICK. I was going to add that you can not be ready unless the plant is running. When war comes—as we hope to-day will be as far off as possible—but whenever it does come, the only way to have the efficiency of that plant is to have the plant in operation.

The CHAIRMAN. Well, I hardly think that would be necessary.

Senator KENDRICK. Mr. Chairman, any plant begins to deteriorate in quality by standing still. That is the first thing.

The CHAIRMAN. Well, we will have to spend a good deal of money to keep it in good shape.

Senator KENDRICK. Yes; and the next thing is the continuous operation of the plant means that improved methods will be installed there as they develop.

The CHAIRMAN. Yes; I think so. We want to do that.

Now, Mr. Worthington, assuming that what we are trying to do is, in making a contract with anybody, we want to make a contract which will insure just as large production of fertilizer in time of peace as possible, without in any way interfering with the fundamental thing, which is more important, even, and that is that this plant should be ready at a moment's notice to produce explosives in time of war. It is Mr. Ford's offer, as expressed in this paragraph, that he is going to run that plant to its capacity in the production of fertilizer.

Mr. WORTHINGTON. It is. I think I can clarify this a little, and since Major Burns is here, I will say this: This plant was designed to produce cyanamide, to get ammonia to be oxidized to make nitric acd. Have I stated that correctly, Major?

Major BURNS. Yes. We had a further objective. So far you are all right, but we had a further objective.

Mr. WORTHINGTON. But I have stated it correctly as far as the ammonia is concerned?

Major BURNS. That is correct.

Mr. WORTHINGTON. That is what I want to establish.

Major BURNS. Yes.

Mr. WORTHINGTON. Now, suppose it is found and that it is insisted upon, and Major Burns will bear me out in the statement that there are those who insist that there are processes that will produce ammonia much cheaper than the cyanamide process; but if, upon research, on a commercial scale, it is found to be true then that the process would serve the military end of this plant in the production of cheaper ammonia just as well as the cyanamide process would serve it. Is that correct, Major?

Major BURNS. Absolutely.

Mr. WORTHINGTON. So that the whole thing that Mr. Ford is ready to accomplish is to find out a way of producing cheaper ammonia. Now, any ammonia produced there can go on in time of war to the military end in this plant, which is the end that seeks the nitric acid. Am I correct, sir?

Major BURNS. Well, I think the War Department would be satisfied if we were assured of an adequate supply of fixed nitrogen in one form or the other. They would be satisfied if it was even in the form of ammonia.

Mr. WORTHINGTON. Indeed, you would, if we produced ammonia by this Casale process. You would get it in the form of ammonium sulphate and you would be satisfied to use ammonium sulphate, just as much as you would to use cyanamide.

Major BURNS. Well, as I said before, if we were assured of an ample supply of fixed nitrogen in one form or another, we would be satisfied.

Mr. WORTHINGTON. Certainly.

Major BURNS. Because mechanical manipulation will allow you to change nitrogen from one form to various other forms.

Mr. WORTHINGTON. Precisely. So it would be entirely in step with your Ordnance Department and its wishes if we produced a very cheap ammonia for agricultural purposes that would serve at the same time for military ends.

The CHAIRMAN. Mr. Worthington, as I understand it, the 110,000 tons of ammonium nitrate mentioned in Mr. Ford's offer is the equivalent of 40,000 tons of nitrogen.

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Mr. WORTHINGTON. Yes.

The CHAIRMAN. Now, does the Ford offer intend to fix nitrogen to the limit of 40,000 tons of nitrogen?

Mr. WORTHINGTON. It does, by whatever fixation process it uses, and certainly no less than that.

The CHAIRMAN. That makes it clear.

Senator KENDRICK. Yes.

Mr. WORTHINGTON. Yes.

The CHAIRMAN. Does the offer intend that the additional fertilizer materials, potash and phosphoric acid, will be purchased or produced with such nitrogen products, in order to make commercial fertilizer?

Mr. WORTHINGTON. Will you state that again?

The CHAIRMAN. Maybe I will make it a little plainer if I state it in a different way. We have found, now, that this offer intends to convey the idea that Mr. Ford binds himself to fix nitrogen to the equivalent of that contained in 40,000 tons of nitrogen or 110,000 tons of ammonium nitrate.

Mr. WORTHINGTON. Yes.

The CHAIRMAN. When we have that we still do not have a commercial fertilizer.

Mr. WORTHINGTON. Yes.

The CHAIRMAN. Now, does his offer bind him to add the additional materials, such as potash and phosphoric acid, so as to make the complete fertilizer, to the extent that a fertilizer may be made up by the 40,000 tons of nitrogen?

Mr. WORTHINGTON. I would not undertake to say whether he was actually bound to do so, but I will say that the language used would absolutely carry him to it, and that, more than that, it is Mr. Ford's intention and that of his engineers, to employ phosphoric acid, processes for producing phosphoric acid, and accomplishing exactly what you have stated.

The CHAIRMAN. Of course, I do not expect Mr. Ford to say that he would necessarily do it in this way; if there is any improvement we would expect him, of course, to utilize it and make it as cheap as possible.

Mr. WORTHINGTON. Yes; it is so indicated.

The CHAIRMAN. Yes; it is so indicated; but I think it is important to know, inasmuch as we are trying to have a commercial fertilizer—and we realize that when he has his 40,000 tons of nitrogen he still does not have a commercial fertilizer—whether Mr. Ford agrees that he will make a fertilizer, put in the other ingredients of phosphoric acid and potash, which are necessary to make a complete fertilizer, to the extent that 40,000 tons of nitrogen would go.

Mr. WORTHINGTON. I should so construe that.

The CHAIRMAN. Well, that is plain.

Mr. WORTHINGTON. And, moreover, we can add that it is backed up by the intention as submitted.

Senator KENDRICK. I just want to say, Mr. Chairman, that the question asked by you is entirely pertinent and important—to have the information which was given as to the attitude of Mr. Ford—but I do not, as one member of the committee, consider it is important that he should perfect the product in the form of ferilizer, for the reason that many other industries in the country find it profitable to take this chemical——

The CHAIRMAN (interposing). This nitrogen.

Senator KENDRICK (continuing). And manufacture fertilizer themselves, and they would no doubt be glad to have it.

The CHAIRMAN. But, Senator, you must remember that when we get nitrogen, while that is a part of the fertilizer that we are going to make down there at Muscle Shoals——

Senator KENDRICK (interposing). Yes.

The CHAIRMAN (continuing). You still have nothing that is any good for the farmer, unless you go ahead and perfect it and manufacture fertilizer. To do that, two things are necessary: You must have phosphorus and you must have potash.

Senator KENDRICK. Yes, Mr. Chairman.

The CHAIRMAN. I understand that those two additions, after you have the nitrogen, would cost a good deal of money. Would they not, Mr. Worthington?

Mr. WORTHINGTON. Oh, indeed. It is expected that they will; but, Mr. Chairman——

The CHAIRMAN. Now, if Mr. Ford is only bound to produce it—if he is not going to go any further than to say, "Here is your nitrogen, and somebody else can make the fertilizer"—he has not done what we want to accomplish.

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Senator KENDRICK. Yes; but I want to say here, Mr. Chairman, that the nitrogen is the one element that enters into this which we must draw from only one source. It is the only element on which there is anything like a monopoly at this time. Both potash and phosphate are easily obtainable from a good many diffrent sources.

The CHAIRMAN. Now, is that true, Senator?

Senator KENDRICK. Oh, yes.

The CHAIRMAN. Of potash?

Senator KENDRICK. Yes. Yes; we have enough potash in Wyoming. It is estimated, to furnish this Nation, according to the estimates of the Interior Department, for 180 years.

The CHAIRMAN. Senator, what form is that in?

Senator KENDRICK. It is potash; it is in lava rock.

The CHAIRMAN. Oh, yes.

Senator KENDRICK. Then, we have phosphate quarries that cover thousands of acres of land.

The CHAIRMAN. Would it not be a pretty expensive proposition to get that potash in shape to mix it with nitrogen and make a fertilizer?

Senator KENDRICK. They had already established a splendid manufacturing plant for potash on the banks of the Green River at the close of the war and would have proceeded to manufacture it at a fair profit but for the collapse in prices. They have a plant out near Cokeville, in western Wyoming, that is producing at this time the phosphates of double strength, as the witness on yesterday morning gave to the committee; so that we come back to the proposition that if we can get nitrates there will be an unnumbered lot of industries that will manufacture the fertilizer commercially.

Mr. WORTHINGTON. May I add a word there, Mr. Chairman?

The CHAIRMAN. Yes.

Mr. WORTHINGTON. And, if possible, clarify the situation from the actual trade experience.

The CHAIRMAN. Yes; go ahead.

Mr. WORTHINGTON. It is not to be concluded that if you could solve the physical difficulties of ammonium nitrates, that some of that would not go directly to the farmer, because sodium nitrate goes as a top dressing; but as to phosphate the greater part of the tonnage consumed in the United States is mixed, as you suggest. A considerable tonnage of nitrate is used in that way, and I might make that very clear before your committee by calling your attention again to the use of cottonseed meal, which has just a shade of phosphoric acid, and it is used for its nitrogenous fertilizer value. So it is a factor, Mr. Chairman, that nitrogen fertilizer is used as such, but not to the extent, by any means, as the mixed goods, as it is called, that you have just discussed. I might say it is not the purpose here to have you conclude at all, either that this ammonium nitrate, using it as an example, if its difficulties might be solved, with some other form of nitrogen, produced from that, could be used. It does not mean that that is going to market to meet the intentions of the contract. That is not what it means.

The CHAIRMAN. I would like to ask you this question, Major Burns:

One of the terms used in Mr. Ford's offer, Major, is that "ammonium nitrate." Is there anything about that term that would be misleading to one trying to understand this proposition? Could you technically comply with it and make ammonium nitrate and still be a good ways from fertilizer?

Major BURNS. Oh, yes; you could only have one of the ingredients of the fertilizer.

The CHAIRMAN. Is it not in such form that it would be ready to mix with potash?

Major BURNS. No, sir; ammonium nitrate, as it stands to-day is not accepted as a good fertilizer material. It has a plant food value, but it has physical characteristics which prevent its being put into mixed fertilizer.

The CHAIRMAN. What would you convert it into if you had to make the fertilizer?

Major BURNS. Well, we would not make the ammonium nitrate.

The CHAIRMAN. You would not?

Major BURNS. We would define our fixed nitrogen in the form of ammonia or some other material, probably ammonium phosphate.

The CHAIRMAN. In making ammonium nitrate you first get nitrogen?

Major BURNS. Yes.

Mr. WORTHINGTON. You first get cyanamide.

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Major BURNS. Oh, yes; by that process, No. 2.

The CHAIRMAN. You would get nitrogen?

Major BURNS. Fixed nitrogen.

The CHAIRMAN. What is the difference between nitrogen and fixed nitrogen?

Major BURNS. The air is full of it, and we are breathing it every minute, but we can not use it.

The CHAIRMAN. Well, we would not get along very well without it.

Major BURNS. Fixed nitrogen is really the welding of the nitrogen of the air to some other nitrogen.

Mr. WORTHINGTON. To carry it.

The CHAIRMAN. Now, what do you weld it to?

Major BURNS. In the case of ammonia we weld it to nitrogen. In the case of nitric acid, in the arc process, you weld it to the arc of the air.

Mr. WORTHINGTON. And in the cyanamide process you weld it to the carbide?

Major BURNS. In the cyanamide process we weld it to the carbide.

The CHAIRMAN. After you have ammonium nitrate, is it an expensive proposition to make commercial fertilizer?

Major BURNS. Yes, sir; it would be, because you would have to get the other materials—potash and phosphoric acid—in order to make commercial fertilizer.

The CHAIRMAN. Take, for instance, the potash that is contained in the lava beds of Wyoming. Is that in such condition that it is practicable to use it for the making of fertilizer?

Major BURNS. I think it is perfectly practicable; yes, sir. But, of course, it all depends upon the economic situation to-day. To-day we are practically importing every bit of potash that we use from Alsace-Lorraine or Germany.

The CHAIRMAN. Taking the market to-day, would it cost less if you were going to use it at Muscle Shoals, with the nitrate that you would get there? Would it cost less to use potash from Germany or France than it would to get it out of the rock in Wyoming?

Major BURNS. I can only give you my judgment on that, Senator, and it ought to be backed up by somebody that knows more about it than I do, but, in my judgment, you could get potash cheaper from Germany or Alsace-Lorraine than you could get it from the rocks of Wyoming.

Senator KENDRICK. Or from the lakes of Nebraska.

Major BURNS. Yes. There is that Searles Lake potash proposition, you understand, of course.

The CHAIRMAN. That potash in Searles Lake is in a very condensed form, as I understand it.

Major BURNS. Yes; and even that can not compete with the imported potash.

Senator KENDRICK. There are some great manufacturing plants in western Nebraska, the chairman's own State, which were in operation all during the war, or nearly all of that time, but I think they are now all closed down.

The CHAIRMAN. Yes.

Senator HARRISON. That is purely on account of freight rates, I imagine, is it not?

Major BURNS. And labor, of course. The German potash deposits and the Alsatian deposits are the best in the world. They are the most concentrated and the most easily extracted and therefore they always have an advantage over the American potash deposits. As you know, during the war, the country was very much worried about potash, and did everything it could to develop the potash industry. I think it wasted material in the Searles Lake development, which was the biggest one undertaken during the war.

The CHAIRMAN. Yes. Of course, when the war was over, these various places where they had been developing potash could not sustain themselves on a commercial basis, and they never would have opened it, probably, except as a war proposition.

Major BURNS. That is it. Another potash development during the war was the kelp-weed plant down at Coronado, Calif., or in that neighborhood.

The CHAIRMAN. Yes.

Major BURNS. As San Diego, Calif.

The CHAIRMAN. Now, Senator, you were going to ask a question?

Senator KENDRICK. I want to ask a question with reference to this product that was used in carrying the nitrates through the process like coke. Is that product destroyed in the manufacturing process and lost?

Major BURNS. Yes, sir.

Senator KENDRICK. It is?

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Major BURNS. With the cyanamide process it is lost. You have various raw materials going into——

Senator KENDRICK. Of course, the lime rock is a part of it.

Major BURNS. That is lost.

Senator KENDRICK. But the loss of that would not be material; but I was wondering if the coke had to be entirely destroyed in the process?

Major BURNS. Yes, sir; that is lost.

Senator KENDRICK. It represents an enormous cost, does it not?

Major BURNS. I can give you that. In a ton of ammonia the coke cost is $13.02 and the limestone cost is $8.81, out of a total cost of $134 per ton.

The CHAIRMAN. Now, taking a ton of commercial fertilizer, how much is the phosphorus cost and how much is the potash cost?

Major BURNS. You will remember, Mr. Chairman, that you asked that question of Doctor Whitney yesterday, as to what he thought the total fertilizer bill in the United tSates was, and he said that during the year 1919 it was about $225,000,000, and you asked him what part of that was chargeable to nitrogen.

The CHAIRMAN. Yes.

Major BURNS. And what part to potash.

The CHAIRMAN. And he did not tell me.

Major BURNS. He said he would give you the figures, and he has not done it. I can give you a very rough summary.

The CHAIRMAN. Well, give us that.

Major BURNS. Which you can check up.

The CHAIRMAN. All right.

Major BURNS. He stated that the normal consumption of fertilizer was 8,000,000 tons per year, and that the average nitrogen content of that is 3 per cent. In other words, it is 240,000 tons. Nitrogen to-day is worth approximately $300 per ton. So 300 times 240,000 would be $72,000,000. Now, if you take fertilizer as worth $30 a ton and the normal consumption is 8,000,000 tons, your fertilizer bill is approximately $240,000,000.

Senator KENDRICK. Or one-third of it.

Major BURNS. So that your nitrogen bill would be seventy-two two hundred and fortieths.

Senator KENDRICK. Or a little over a third.

Major BURNS. Or a little more than a third.

Senator KENDRICK. It would represent about one-third of the cost.

Major BURNS. A little less than one-third of the cost.

The CHAIRMAN. Would the other two-thirds be divided between potash and phosphorus?

Major BURNS. I can not answer that question. I do not know what these costs are.

The CHAIRMAN. Can you tell, Mr. Worthington? Have you any information on that subject?

Mr. WORTHINGTON. I think it was in 1916 that the answer to that question was put into the record before this committee, and I can only give you my best memory on it. I think the fertilizer bill was estimated at from $150,000,000 to $175,000,000, and that the nitrogen part of the bill was about $80,000,000, the phosphoric acid part of the bill about $40,000,000 and the potash part of the bill about $30,000,000. Of course, I would like to reserve the right to correct those figures.

The CHAIRMAN. Certainly.

NOTE.—During the year 1914 there was expended for commercial fertilizer in the United States $186,000,000, divided as follows:

For nitrogen	$78,000,000
For phosphoric acid	65,000,000
For potash	43,000,000

Mr. WORTHINGTON. Because they were presented to the committee in 1916.

The CHAIRMAN. On account of illness, Mr. Worthington, I was not able to attend more than one or two of those hearings. They were exceedingly interesting.

Mr. WORTHINGTON. They were.

The CHAIRMAN. I always thought I would read them, but I have not been able to get to it yet.

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Mr. WORTHINGTON. A great many of the questions, I notice, that you are asking, were answered then, and very intelligently, too. I am going to presume to suggest that by reading Mr. Bower's testimony in 1920, before your committee, and especially his testimony before the Military Committee a short time since, and by having him come before this committee all of this discussion of this morning will be made perfectly clear. As to this whole mixing question, I think he states the case with greater clearness than I have ever read anywhere else.

There is a part of the nitrogen fertilizer of the country that is, of course, used directly. For instance, ammonium sulphate is used in sugar cane growing directly. Ammonium sulphate is used on the orchards also.

The CHAIRMAN. As a spray?

Mr. WORTHINGTON. No; as a fertilizer.

The CHAIRMAN. As a fertilizer?

Mr. WORTHINGTON. You use it yourself, do you not?

Mr. SILVER. Yes; carload after carload is used in my home county annually on orchards, just ammonium sulphate

Mr. WORTHINGTON. And if I may press the point, the problem is to get this ammonia down.

The CHAIRMAN. Now, Senator Kendrick, you wanted to ask Mr. Worthington a question when I interrupted you.

Senator KENDRICK. I believe it was very well covered by the answer of Major Burns.

The CHAIRMAN. All right. Now, Mr. Worthington, there is another question that I want to ask you. This proposition of Mr. Ford's that I have read says that the company which he organizes agrees to operate the plant at approximately the present annual capacity of its machinery and equipment, "in the production of nitrogen and other commercial fertilizers."

Mr. WORTHINGTON. Yes.

The CHAIRMAN. If I understand his offer—and I think I do now fully—I think the word "other" ought to be stricken out. I think it has a misleading effect. Nitrogen is not a fertilizer.

Mr. WORTHINGTON. It is, Mr. Chairman.

The CHAIRMAN. It is one of the ingredients.

Mr. WORTHINGTON. Yes; and it is used as a fertilizer itself.

The CHAIRMAN. Is it a commercial fertilizer?

Mr. WORTHINGTON. Yes, sir.

The CHAIRMAN. Is that right, Major?

Major BURNS. I think it all depends upon the point of view. It is not a rounded out commercial fertilizer.

Mr. WORTHINGTON. Yes; when it is used like Mr. Silver does on his orchard, it is a fertilizer.

The CHAIRMAN. Do you use the pure nitrogen?

Mr. WORTHINGTON. He uses the ammonium sulphate, which has as much as 24 per cent of ammonia in it, and the Chilean nitrate has the equivalent of about 16 and 17.

The CHAIRMAN. You are not using nitrogen when you do that.

Mr. WORTHINGTON. No; but it goes to the plant in the form of ammonia.

The CHAIRMAN. It may go to the plant that way.

Mr. WORTHINGTON. But you do not do anything more than take the nitrogen as it comes to you.

The CHAIRMAN. Exactly.

Mr. WORTHINGTON. That is what you get from Chile.

The CHAIRMAN. Is that pure nitrogen?

Mr. WORTHINGTON. Oh, by no means. You can not produce that.

The CHAIRMAN. All right. What I am objecting to in this contract is that it says that nitrogen is a commercial fertilizer. Now, you say it is, and to prove it, you say that the potash or the stuff that we get from Chile, just as it comes, is not nitrogen, and there is no proof at all, then.

Mr. WORTHINGTON. I would like to make a suggestion to you right there.

The CHAIRMAN. All right.

Mr. WORTHINGTON. It says in the production of nitrogen and other fertilizer compounds, and nitrogen is a fertilizer compound.

The CHAIRMAN. No, Mr. Worthington; you have that wrong. You have quoted it as it was originally made, but that has been amended twice. The word "compounds" is stricken out by Mr. Ford in his amended offer.

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Mr. WORTHINGTON. I stand corrected.

The CHAIRMAN. And before the word "fertilizers" Mr. Ford has inserted the word "commercial," so it now reads, "in the production of nitrogen and other commercial fertilizers." That is the way it reads now.

Mr. WORTHINGTON. I stand corrected, and ask the opportunity to discuss that situation with Mr. Mayo.

The CHAIRMAN. I wish you would.

Mr. WORTHINGTON. At present, I think you are right.

Senator HARRELD. Here is what might happen and what I am afraid of. If you put the word "compound" in there it would be all right.

The CHAIRMAN. No; the word "compound" is stricken out. The idea in this amended proposition was to get a practical proposition, which is a commercial fertilizer. That is what we are after.

Mr. WORTHINGTON. Similar to a fertilizer we can use.

The CHAIRMAN. Well, a commercial fertilizer is one we can use.

Mr. WORTHINGTON. Yes.

The CHAIRMAN. Before it was "commercial compound"? In carrying out the idea that Mr. Ford had when he struck out the word "compounds" and inserted the word "commercial," he changed the word from the singular "fertilizer" to the plural "fertilizers." That is just what he did. He carried that out, and that is the idea we want to carry out. That word there ought to be stricken out, I think.

Mr. WORTHINGTON. I will discuss it with Mr. Mayo at once.

The CHAIRMAN. All right. Now, there is another proposition that I want to talk to you about. It is in the same paragraph. He agrees to do all of these things that we have mentioned, but here is the exception to it. I will quote this: "Except as it may be prevented by strikes, accidents, fires or other causes beyond its control, and further agrees"—

Personally, I do not agree with some of the critics who have criticized that language, and if it had not been criticized and my attention called to it. I do not know that I would have been asking you these questions; but if there is any possible doubt about that it ought to be clarified. Why would not Mr. Ford be properly protected, without any danger of the Government being injured, if that exception were confined to acts of God?

Mr. WORTHINGTON. Your suggestion has been discussed rather extensively; and, while I am not sure about it, I believe the result of the discussion on the House side is that, after a thorough discussion, it seems that it is satisfactory and that your first impression is correct. On that point I will ask Mr. Mayo's attention for the committee.

The CHAIRMAN. My idea, Mr. Worthington—and that is the reason I am calling attention to it—is that this clause, in my judgment, is the most important one in the whole contract, because this is what Mr. Ford agrees to do, or, should I say, what the corporation agrees to do. No one would think for a moment, of course, that if Mr. Ford were operating that corporation that he would intentionally bring on a strike or that he would arrange things so that there would be an accident or even a fire, or anything else beyond his control; but he is going to die in a few years, and the corporation is to run it, and it will be just like any other corporation it will not have any soul nor conscience. It will take advantage of every technicality that it can wherever it can be benefited by it. An unconsionabe person might, and I think it has happened in other cases that people who own property have purposely brought on a strike. They could do that easily if they wanted to. If this corporation sought to have a strike of its employees it could have one every month, and could get a new set of employees and have another strike, because it could make things so arbitrary and so inhuman that any bunch of men would strike.

Mr. WORTHINGTON. Mr. Chairman, I have often wondered, on hearing that phase of the case discussed, how on earth you could keep any corporation from doing that evil thing by any phraseology in the contract? I do not believe you can do that.

The CHAIRMAN. But it might relieve them from damages; you could make a contract so that if you had a strike it would not be any defense if you sued for damages.

Mr. WORTHINGTON. Well, in general answer to what you have said, I will take that up with Mr. Mayo right away and see if it can be made satisfactory, because it is his desire and that of Mr. Ford to make it so.

Senator HARRELD. Right there, I want to ask Mr. Worthington a question or two, if you please, Mr. Chairman.

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The CHAIRMAN. All right, Senator, go ahead.

Senator HARRELD. I would like to see that language, if you have it there.

The CHAIRMAN. It is in paragraph 15.

Senator HARRELD. I want to call your attention to this part of the provision which says, "causes beyond its control." That raises a point that has been troubling me, and I want to get your opinion on it. We are giving a contract here for 100 years. I do not know whether I could make myself clear or not, but Mr. Ford agrees to produce fertilizers there, except when he is prevented by certain things, one of them being "causes beyond his control." Now, I will ask you this hypothetical question: Suppose, as the science of chemistry advances, some man invents a formula by which these nitrates could be made and patented so that Mr. Ford or his corporation can not obtain those patents and by the terms of the patent they can produce nitrates so cheaply that Mr. Ford can not produce them in his plant. Is that a matter that is beyond his control, and would that justify him in ceasing to try to manufacture nitrates and fertilizers, and would it excuse the company from any further operations along that line and leave it free to use its power for any other purposes for which it has a monopoly for 100 years? That is the objection that I have to this contract.

Mr. WORTHINGTON. Presupposing that the occasion should come about, and I am not indicating that he would try to get out of it; but would there be any use of his running that plant if the circumstances you have described occur?

Senator HARRELD. No; there would not be, but that is the very thing, that he has a monopoly for a hundred years without having to comply with the terms of this contract to produce fertilizer.

Mr. WORTHINGTON. And would not that be the greatest blessing the country could have?

Senator HARRELD. Not for his company to have that monopoly on that plant down there.

The CHAIRMAN. Now, if I may interrupt you there, gentlemen, it seems to me if that does happen we will all thank God. If it does, somebody will get a cheaper price.

Senator HARRELD. Yes.

The CHAIRMAN. But, on the other hand, as the Senator says, if the people will get fertilizer so much cheaper that Mr. Ford could not afford to make it there, we would not want him to make it; and instead of using this power to run that machinery he would have it donated to him.

Senator HARRELD. That is the point.

The CHAIRMAN. He would have donated to him 100,000 horsepower, which he would get free from the time that thing happened until the completion of a hundred years.

Senator HARRELD. That is the point; and he could use it for commercial purposes.

Mr. WORTHINGTON. Mr. Chairman and gentlemen, I had no intention of saying what I am about to say, but I am ready to meet the suggestion of the Senator and to defend this offer and insist that it is all right even if what he says may happen.

The CHAIRMAN. Let me finish the point I was starting to make.

Mr. WORTHINGTON. Yes; I thought you had finished.

The CHAIRMAN. No; I had not quite finished, and you really helped me by the suggestion you have made. The reason I am making the suggestion is this: It demonstrates, it seems to me, that it is a physical impossibility for the Government of the United States, on this uncertain proposition that we all hope and pray is going to be improved—it is a physical impossibility to make a contract with anybody that can properly contemplate the future. It is no disrespect to Mr. Ford or his company or anybody else that such a thing might happen, but that very thing is liable to happen. I do not know that it will, but that or something like it may happen; and there is no implication, even indirectly, of bad faith on the part of anybody.

Senator HARRELD. No.

The CHAIRMAN. It is something that has to develop in the course of nature, and it has seemed to me that something along the line of the bill that I have introduced ought to become the law, so that if such a thing does happen nobody will be hurt and nobody will get an undue advantage and the Government of the United States and the people who use the fertilizer will be protected.

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Senator HARRELD. I want to say in that connection that I am not impugning Mr. Ford's motives. In fact, I would like to see the contract made, but you can see that if anything of that kind happens this company would have 80 or 90 or 100 years of cheap power and might use it commercially. That would give him an advantage commercially over everybody else that sought to make power. There is no other water power like that in the United States outside of the Canadian border.

Mr. WORTHINGTON. If the committee will be pleased to listen to me——

The CHAIRMAN. We would. We would be very glad to hear from you.

Mr. WORTHINGTON. I am sorry that I did not get to make my statement before the chairman made his, because his statement brings me under the embarrassment of a discussion of Government operation, and of course the committee knows I can not go into that with the chairman. He would use me up here in a minute, but just waiving that, and with all due respect, I want to impress upon you now what I regard as the economic fundamentals of this water-power question in this country, and I think it will be a full answer to the assumed possible occurrence that you are trying to guard against.

Of course you may say that you can protect the agricultural and industrial interests of this country better, cheaper, and more securely by Government operation than under this Ford proposal. As I say, I have to pass that by.

Now, let us come down to the practical thing.

It has been said that this proposal, if you accept it, will subsidize Mr. Ford, and you indicated it in terms by your question. I want you gentlemen, please, to take the trouble, in clearing up in your minds the very question that you have raised and look into what has happened in the Province of Ontario, Canada, in the last 15 years, and especially do I press upon you the Queenstown-Chippewa development just completed. You will find, I am sure, when you investigate the hydroelectric power-development service in the Province of Ontario that since the power commission of the Province was established, the head of which is Sir Adam Beck, they are using 4 per cent money.

Now, I want to ask you, Mr. Chairman and other members of the committee, how can you compete in this country with their water power? How can you expect to get the electric-furnace industry to grow in the United States if at the Queenstown-Chippewa development of about the same capacity at Dam No. 2 at Muscle Shoals power is developed with 4 per cent money any you let any private power company develop Dam No. 2 with 8 and 10 per cent money?

I do insist that this Canadian situation confronts you with one of two things that you are compelled, in protection of agriculture and the industries of the United States, to provide 4 per cent money or you have got to go into it yourselves.

The CHAIRMAN. Now, Mr. Worthington, I agree with you.

Mr. WORTHINGTON. There is no escaping it. You may talk like we have for the last 15 years, and you may talk 15 years more, but you are nailed down to it.

The CHAIRMAN. And of course either in the way of a subsidy or directly, as the Government is about the only bunch of people in this country that can furnish 4 per cent money.

Will you let me again call your attention to this report that I mentioned the other day——

Mr. WORTHINGTON. Yes; indeed. I have been reading it.

The CHAIRMAN. In which they say that this governmental power concern controlled by Sir Adam Beck—that 's his name, is it not?

Mr. WORTHINGTON. Sir Adam Beck is the head of it.

The CHAIRMAN. Murray's report?

Mr. WORTHINGTON. Yes.

The CHAIRMAN. That report says that the power produced over there in Canada is selling at a higher price than our privately produced power in the United States, and that they are not competing with us at all. In other words he reaches the conclusion that the privately developed power here, where they have to use 8 per cent and 9 per cent money, as you say, is selling electricity to the consumer cheaper than they are doing it in Canada, where they get the 4 per cent money by virtue of Government operations.

Senator HARRISON. Is that just one Province up there or the General Government of Canada?

The CHAIRMAN. That is one Province. It is the Province of Ontario.

Mr. WORTHINGTON. The large water-power developments in Canada are in the Province of Ontario.

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The CHAIRMAN. I am not saying that is not qu'te true. I have not investigated it. I am not saying that it is not true that they are producing power up there cheaper than we are producing it in America. In fact, the argument was made by this American Cyanamid Co. that it went to Canada because they could get cheaper power in Canada.

Senator HEFLIN. They really went to Canada because the President vetoed the dam act at Lock 18.

The CHAIRMAN. Yes; because the power was so cheap there.

Mr. WORTHINGTON. Mr. Chairman, suppose, if you please, that you waive Mr. Murray's statement, which I can not agree with, and let us face this as a general proposition, and let us inquire how it is that Canada, previous to the 10 years previous to 1920, say, developed and put into service in the Dominion about a million horsepower, and in that period we developed none in any navigable stream in this country with the possible exception, maybe, within that period of Lock 12 on the Coosa River. I am not certain about the year. Since that time, and in further contrast—and it is a humiliation to this country—you will remember that this Queenstown-Chippewa development was started in 1917, and that the order for starting the work on Dam No. 2 was in Febuary, 1918. With all respect, I wish to say that this case that I am bringing to you now has confirmed the view I have entertained for a long time, that there is something the matter with our method of dealing with water-power development in the United States. I do not know what it is, but there is something wrong with us, Mr. Chairman, because there is that development started, as I remember, in 1917, with perhaps 150,000 horsepower, nearly ready for service, and the rest to be soon installed up to nearly 600,000. On the other hand, our development, the Government development at Dam No. 2—and this was a Government development in the Province of Ontario at Queenstown—we find that we have a development started about the same time that, according to the testimony of the Government engineers it is going to take three years to finish. Now, before that three years has passed the entire 600,000 at Queenstown will be serving those people, and the industries of Canada.

The CHAIRMAN. Is it not true that the kind of a dam you had to build there is a vastly different proposition?

Mr. WORTHINGTON. Oh, but if you will please go back into the reports of the engineers, they said it would be finished in three years. No, sir; I don't believe that while the design of the structures is different there is any appreciable difference in the difficulties that attend the completion.

The CHAIRMAN. I would not want to put my opinion against yours, of course, on a proposition of that kind, Mr. Worthington; but unless you are familiar with the kind of a dam they are building up there, I would not want to take your statement just as you have given it, because my impression is—I may be wrong, of course—that the dam that we are building, Dam No. 2, from the very nature of things, must take a great deal longer than the kind they had to make up there. In other words, this Dam No. 2 will be the largest concrete dam in the world when it is completed. That is one of the difficulties of damming the Tennessee River, the length of the dam.

Mr. WORTHINGTON. That is true. I could not hope by this discussion to-day to convince you on that point, but I am going to ask you to give me the opportunity to convince you that the two developments could be built in about the same time. If I do, I have made my point. If I do not, I have failed.

The CHAIRMAN. It would be interesting to hear you on the subject whether you could do it or not.

Mr. WORTHINGTON. The discussion of it here would not accomplish it, because it would still be a matter of opinion. But I can bring the facts to you. There is no question about it.

Now, then, just nailing this down a little nearer, at the hearing the other day I handed to the chairman an advertisement taken from the Washington Post of the day before, and raised in the minds of the committee the question why did this proposed electric steel alloy plant go in Canada at all, and if we do not in some way establish a policy that will develop larger water powers of the country that require so much capital, like Muscle Shoals, we are going to lose, as we have in the past, the electric furnace industry to Canada, because Canada is going forward with this cheap money that is criticized in this case as a subsidy. Whether it may be fairly called a subsidy or not, the fact remains that if they set down a subsidy in their water powers, we have got to meet them if we get the business.

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The CHAIRMAN. Now, I want to ask you, Mr. Worthington—I think it will be illuminating—the difference in power development North and South, and I am asking entirely for information, because I think it will help to illuminate the subject.

One of the difficulties with every water power is the difference between the flow of the stream, its maximum and minimum flow, so that there is so much secondary power. Now, is it true that in the North, like in Canada, or in the northern part of our own country, where the flood is held back by reason of it existing in the form of snow and ice, and thus distributed over a longer period as it flows down the stream, making the flow more equal, while in the South, where there is no snow, it all comes down at once? Does that fact give an advantage to a northern stream over a southern stream, and give an advantage to Canada over the United States in water-power development?

Mr. WORTHINGTON. Unquestionably and obviously so. The Queenstown-Chippewa development is constant primary power, whereas in the streams of the South, which you refer to, every one of them has its low-flow season, and there is no way to get the maximum economic result unless you provide some way to fill in the low gap. Now, we have to install as we have, and as it is the practice to do at present, a steam auxiliary plant to do it. In the case, however, of a number of our streams in the South, the more permanent and economic thing to do is to go on the headwaters and establish reservoirs, which would control the flood flow of those streams during the rainy seasons, and then you would let the water come down the stream during the dry season to preserve the power as primary.

The CHAIRMAN. I suppose in the northern streams to-day there is some difficulty they do not have in the southern streams, in the way of handling the ice proposition. That makes some difficulty?

Mr. WORTHINGTON. It must be granted that power distributed in Canada has its hazards on account of cold weather.

Senator HARRELD. Mr. Worthington, referring to my question, could there not be a provision put in this contract that in case any one of these exceptions mentioned which would release Mr. Ford from that part of his contract which obliges him to manufacture fertilizer—if any one of those causes for exception were to arise for a certain time, that the Government might protect itself against having the company released from that part of its obligation in some way where it could control this water power for commercial purposes? I don't know whether that is practicable or not; but that is the objection I have to this contract.

Mr. WORTHINGTON. Yes. I will reserve any answer. I had not thought of that phase of it. But of course I am not authorized to commit Mr. Ford and Mr. Mayo about it, but I will discuss that phase of it. I don't presently see how——

Senator HARRELD. Keep in mind, now, our purposes are these in letting this water power to any private institution: First, to get fertilizers in times of peace; and, second, to get nitrates for use in time of war; that if it were not for these reasons we would not be spending all this time trying to negotiate this thing.

Mr. WORTHINGTON. That is true.

Senator HARRELD. Now, if the condition arises which deprives the people of that right of contract, then we do not like to be left in the attitude of having a company with a monopoly on the power, which is the greatest power in the United States, which it may use, as it would under this contract, for commercial purposes. That is my objection—the main objection.

Mr. WORTHINGTON. I appreciate the point you raise. I will discuss it with Mr. Mayo and I hope you feel this way, that there is a disposition to try to meet your views, if possible. I know that is true, but I trust you will bear in mind that in some cases it is very difficult.

The CHAIRMAN. Of course, we have a difficult proposition ahead of us and we all concede that. I think it would be well, I think it could be easily done, and I don't see why Mr. Ford's representatives should object to it, to provide in the contract for a contingency that may happen, and that we all hope and pray will happen—that is, that some method will be discovered by which we can get nitrate from the air at a very much reduced cost. Perhaps it will be a method where power will cut very little figure.

Mr. WORTHINGTON. Yes; we hope so.

The CHAIRMAN. Yes; we hope so. If that should happen then we don't want Mr. Ford to be making fertilizer down there at a loss, and he doesn't want to

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do it. On the other hand, if he does not have to make fertilizer he has got a whole lot of power that he ought to divide up with the Government—any profit there may be in it—because he has been relieved—for he has been relieved from compliance with the only part of his contract that is difficult and that will cost him lots of money to comply with. Now, why could there not be a provision in the contract that would in substance provide that if some new invention were discovered, or if, let us say, the Agricultural Department should decide that it was no longer desirable and was not economy to use this plant to make fertilizers, thereupon the obligation of the company to operate the plant would cease, and the power that was thus released should be settled on some other basis.

Senator HEFLIN. In a case like that, Mr. Chairman, it might be that we might get in a Secretary of Agriculture who might be interested in the production of fertilizers himself, who might issue an order to put Ford out of business as a competitor.

The CHAIRMAN. That is very true, Senator, and of course we would want to provide that that could not be done. It might be well to say that it shall be done by act of Congress, or something of that kind. But it seems to me that there is a condition that I think is going to come. It may be that we will still want to use this plant and this power. If that is a fact, it won't make any difference. Everybody thinks that we are going to take this industry and revolutionize it as time goes on.

Mr. WORTHINGTON. Yes, sir.

The CHAIRMAN. We all believe that is going to happen. When that thing does happen we do not need to have a great big plant there, with $90,000,000 invested as a war measure or as a peace proposition, either one, and we want to use it for something else.

Senator HEFLIN. But the crying need now is for cheaper fertilizer?

The CHAIRMAN. Yes, sir; that is right.

Senator HEFLIN. Mr. Ford's representatives come here and tell us that they believe that he can make it for half the cost that is put upon the farmer for it to-day, and everyone of these witnesses who opposed the Ford offer have laughed at the idea of reducing the price. Is not that so?

Senator HARRISON. I should imagine, Mr. Senator, of course, if there was a new patent on this proposition and Mr. Ford was operating that plant, he could enter into an agreement with them to use their new patent?

Senator HARRELD. Yes, sir; but, Senator Harrison, if Mr. Ford passed away, we will say, 20 years from now, it might suit the purposes of his successors to get released from the contract. They might welcome an opportunity to be released from this contract. Therefore, they would not try to make an effort to get the right to use this other patented process.

Senator HARRISON. There is no question about that. May I ask—I notice in your original proposition, that of July 8, that exception was not in?

Mr. WORTHINGTON. What exception?

Senator HARRISON. This exception that Senator Harreld has been speaking about here, "except as it may be prevented by strikes, accidents, fires, or other causes beyond its control."

Mr. WORTHINGTON. I think it was in.

Senator HARRISON. I looked through it here and I could not find it.

Senator HEFLIN. The point I was making, Mr. Chairman, was that these fertilizer people fear that Ford will reduce the price of fertilizer to the farmer, and that is why they are fighting him. Now, if we do accept his offer and he does reduce the price of it, and does so for a few years, the Government has done a great act in letting him have it, even if this other contingency should arise.

Senator HARRELD. Would it justify a hundred year monopoly on all that power down there, though?

Senator HEFLIN. That could be safeguarded in the contract. This is just a statement of what he offers to do. The Government has not had the contract written yet that he is going to enter into.

The CHAIRMAN. I have not said anything about this offer, or this belief, rather, that Mr. Ford is going to cut the price of fertilizer in half, because I know it is not in the contract, and nobody is bound by it. He hopes and thinks that they can cut it in two. But nobody has bound himself in any offer that he will do it, and nobody is going to bind himself that he will do it.

Mr. WORTHINGTON. No.

The CHAIRMAN. Because that is an uncertainty.

Mr. WORTHINGTON. That is to be established.

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The CHAIRMAN. But I suppose it is proper to conclude that whatever hope there is in cutting down the price of fertilizer, especially in the use of this plant, is confined to cutting the cost of the method by which the nitrogen is extracted from the air, and that is only one part of a fertilizer.

Mr. WORTHINGTON. It is only one part, and the complete fertilizer has to be considered, and in reducing the cost of complete fertilizer at Muscle Shoals, surrounding economical conditions are found such as are found nowhere else for such a plant.

The CHAIRMAN. I think that is true.

Mr. WORTHINGTON. That all will go to make the ultimate mixture cost less.

The CHAIRMAN. Yes. Now, in reducing the cost of fertilizer it can be done in one of three ways, or in all three ways, or in two out of the three. One is to reduce the cost of nitrogen.

Mr. WORTHINGTON. Yes.

The CHAIRMAN. That is what this plant produces down there is nitrogen, and I suppose Mr. Mayo's idea of reducing the cost of fertilizer was that Mr. Ford would be able to improve the method by which nitrogen is taken out of the air.

Mr. WORTHINGTON. Yes, sir.

The CHAIRMAN. But you could reduce the price of fertilizer if you could cheapen the phosphate or the sulphuric acid part of it?

Mr. WORTHINGTON. If you could reduce the cost of the phosphoric acid by using electric-furnace methods, just as you produce nitrogen by electric-furnace methods, you could get finally the two components together, both reduced in cost, and, of course, the price per ton is reduced.

The CHAIRMAN. And then perhaps some other method discovered by which potash would be reduced, or a new supply of potash discovered?

Mr. WORTHINGTON. Certainly.

The CHAIRMAN. And if that should occur and the other two things should occur, you would be reducing the cost of fertilizer in three different directions.

Mr. WORTHINGTON. Certainly.

The CHAIRMAN. I suppose in considering Mr. Mayo's testimony we ought to consider that Senator Heflin gives it a great deal of weight, while I have not, because while he said that, he did not pretend to bind Mr. Ford that he would do that, and, of course, he would not undertake to bind him, but I suppose he was thinking then or had reference to the cheapening of the process by which nitrates would be taken from the air.

Senator HEFLIN. Mr. Chairman, he told the automobile makers that he would make cars that the common man could buy and they laughed at that, but he did it.

The CHAIRMAN. Well, he has not gotten quite down to where I can buy yet.

Senator HARRELD. You must remember that this fertilizer trust that you are talking of are working along this same line, to reduce the price of fertilizer.

Mr. WORTHINGTON. Where?

Senator HARRELD. Well, they will as soon as they have any competition. Now, you are aiming to give them competition. They will have to go to work and reduce prices, and they may be able to reduce the price so that you can not compete with them.

Mr. WORTHINGTON. The country gets the benefit of it.

Senator HARRELD. That is exactly what we want to assure, that the country will get the benefit of it.

Senator HARRISON. Let me ask you why was this exception left out of your original proposition?

Mr. WORTHINGTON. I don't know, Senator. I do not now recall the details, myself, since June of last year, but I will get you the answer.

Senator HARRISON. Of course, except by the act of God, that would eliminate the point that has been raised.

The CHAIRMAN. May be he is not willing to do that.

Mr. WORTHINGTON. Well, I will undertake to see. I would like to get before the members of the committee that went to nitrate plant No. 2 this suggestion. Assume, please, that we find a process for producing ammonia that would cut out your quarry, that would eliminate all of the limestone processing, that would make it unnecessary for you to have any coke processing—and as you went through those buildings just imagine that you could cut all that out.

The CHAIRMAN. And you would revolutionize it.

Mr. WORTHINGTON. Now you are going straight to ammonia, as I tried to get before the committee.

The CHAIRMAN. Yes.

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Mr. WORTHINGTON. Now, what is in Ford's mind has something to do with this contract, and I have many times thought that in hearing just such a discussion as we have had here to-day, that you have got to take something on the faith of the future or you will never get anywhere with it, and I remember very well on June 14, when Mr. Ford was there, the question he first raised when he got there and went through the plant was, "What is all this for?" He says, "There is some way to cut this out, and it has got to be found."

The CHAIRMAN. Well, it seemed to me that way. I don't know that I hear any resemblance to Ford, but that is what I think and what I thought when I looked at it.

Mr. WORTHINGTON. That would seem to carry to your minds, you having seen the plant, just what is in his mind and what he will attempt. Now, no one here at this table would say that he ought to sign to do it, because he does not know yet.

The CHAIRMAN. Oh, no. Nobody could be expected to do it. But, now, speaking of the improvement that might be made, for instance, there is the Waco quarry, 26 miles away. We own a railroad from that quarry over to this plant, don't we?

Mr. WORTHINGTON. Oh, no.

Major BURNS. No.

The CHAIRMAN. Do we ship it over there?

Mr. WORTHINGTON. No. It is shipped over by the Southern Railroad.

Major BURNS. There is a spur there.

The CHAIRMAN. We own the spur?

Mr. WORTHINGTON. Yes.

The CHAIRMAN. I thought we owned the railroad.

Mr. WORTHINGTON. No; you just own the spur.

The CHAIRMAN. Well, it has to be done just the same, no matter who owns it, and we have to own the property over there, we have to quarry it, we have to crush it, we have to ship it, we have to unload it in its crushed form, and then we have to put it in the machinery, and we use 1,200 tons of it every day when we are running, and when we get through with it we throw it away. We don't use any of it. It is no good excepting as a conveyor to carry some chemical product to some other chemical product, and we have to go through an operation to put them together, and after we get them together and pass that along a ways, we have to go through another process to take them apart.

Mr. WORTHINGTON. That is the proposition down there, and there is the invitation for improvement.

The CHAIRMAN. That expense of converting that limestone, after you get it down there, 1,200 tons a day, into lime, that enormous machinery, covering acres of land, it passes through those great big revolving tubes, heated by electricity, all for the purpose of finding a conveyor of the chemical from one chemical to another, and then you have to go to the expense of separating it after you have got it together.

Mr. WORTHINGTON. The cyanamid process has been said to be the most wasteful mechanical operation that was ever discovered?

The CHAIRMAN. It seems to me it is The funny thing to me always was whoever thought that by going through all that monkey business such a result could be obtained. I don't see how he conceived the idea, to begin with. If I were going to get nitrogen from the air I would not think of getting a lot of lime to carry it and convert it into something else.

Mr. WORTHINGTON. I think it is safe to say that Doctor Corey and Doctor Frank, in Germany, tried, but they couldn't.

Senator Harreld, I wanted to say this, that in view of what the chairman has so pointedly described, if Mr. Ford discovers a process for producing ammonia that will economically cure the evils which the chairman has just stated, and he does get a monopoly of the power, do you think the country would not have got, indeed, a fair return, in view of the fact that you have, as has been recently estimated, over 30,000,000 of horsepower in the United States undeveloped, and I just wondered if maybe your fears were not quite impractical?

Senator HARRELD. Oh, but, Mr. Worthington, let us eliminate Mr. Ford as a person.

Mr. WORTHINGTON. Yes; I am willing to do that.

Senator HARRELD. It may not be to the interest of that company to reduce the cost of fertilizer.

The CHAIRMAN. The fertilizer trust may own the corporation by that time.

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Senator HARRELD. Yes; and maybe it will be to their interest to let fertilizer stay so high that some other fellow will make it cheaper than they can, so that they will be relieved, under these exceptions, from the terms of the contract.

Mr. WORTHINGTON. Yes; and that leads me to say quite frankly that I believe your very righteous desire to safeguard the future in connection with power legislation, in connection with this very power act that we have—well, I will have to say I think you overshot the mark, and you have failed to get what you were after, and I think I could show it to you, and I think your difficulty is of such a kind that you can not quite put a cylinder under it and hold it.

Senator HARRELD. You will agree with me that if this company did have designs of getting rid of this contract after they once entered into it, getting rid of that part which binds them to make fertilizer, the best way in the world for them to do it is to quit trying to reduce the price of fertilizer and let somebody else reduce it to a price where he could not compete.

Mr. WORTHINGTON. Yes; but, Senator Harreld, you bring that discussion into a field, you know, that I am not your equal. You are experienced in discussing just such questions as this and I am not But there is just one thought I want to leave with you, and that is this, that if any such conditions as you have described ever does arise the people of Alabama and the people of the other States of this country will get the man by his business neck that undertakes it, and it is the history of this country in the past that the people have done it, and they are going to do it in the future.

Senator HARRELD. They have not been able to curb some of the monopolies.

Senator KENDRICK. They have not?

Senator HARRELD. You bet they have not. I think the Standard Oil Co. is bigger than the Government to-day

I want to say this for Ford. I believe in good faith he intends to carry this out.

Senator KENDRICK. I want to ask whether we are proceeding to discuss each paragraph as we come to it, or whether we shall just ask Mr. Worthington any questions we may have in mind.

The CHAIRMAN. Oh, I am through with the questions I put him on the stand to ask.

Senator KENDRICK. I would like to ask Mr. Worthington as to the limitation of time on this lease. As one member of the committee I would object seriously to the length of time that has been named in this lease, because I agreed to the fullest extent with an expression of former Secretary of the Interior Lane, in which he said that he did not believe any of these leases on our natural resources—and that would mean our national resources—should extend over a period of 50 years, because, he said, "It is my conviction that the generation that comes after us ought to have a chance to pass upon these questions themselves. They may have different ideas about them from what we do."

So in all good faith and with an interest in Mr. Ford's proposition, and hoping that we may reach an understanding with him, I want to ask you if that time limit is final, if that question of time is a final proposition?

That question could be narrowed down, I think. My idea is, now, is Mr. Ford's proposition on that question of time in the form of a final conclusion about it, or final offer?

Mr. WORTHINGTON. Senator, I will have to answer that it is, but with this desire in answer, that if you would allow me to come to your office and bring some maps and information with me I think I can convince you as to this case that it is a case standing out by itself, and if you would allow me to do it. I would come.

Senator KENDRICK. I will say, Mr. Worthington, I should be very glad to discuss it with you, but I would think it only fair to you to say that you would have a difficult and uphill task to convince me that when we have now assumed to safeguard and conserve these great natural resources in the interest of the people, to deliver them over to anybody for a period of such a length of time that it means practically final, so far as we are concerned as a Nation, is the proper thing for us to do.

Mr. WORTHINGTON. Well, first, Senator, this Muscle Shoals road has been all uphill to me anyway, and you don't discourage me by that suggestion; but I want to add one thing. I want to raise one question in your mind. May it have been just possible that after all the nailing down of 50 years as the period under which you would allow these developments in the navigable streams to be made was a mistake. I would approach you that way.

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Senator KENDRICK. That is all right. I answer the question in the spirit it was put. It is my opinion that it is safe to believe that 50 years, at the rate we are now moving, is too long, as it is that the period of time is too short.

The CHAIRMAN. In other words, Senator, you believe that 50 years is a maximum?

Senator KENDRICK. I do.

The CHAIRMAN. I agree with you. I think when we are going 50 years we are going an awful ways, and there has got to be something that makes it all out of the ordinary to put it even that way, it seems to me.

Senator KENDRICK. I am glad to have this opportunity to give expression in the record to my feeling about it. My attitude is a favorable one toward Mr. Ford, because of his record of doing things, and all the influences that he has brought to his home community. He would certainly be a helpful element in the development of that whole country. But we ought to, Mr. Ford ought to, and the men who are responsible in speaking for the Government ought to pass upon this question with the full recognition of the fact that we are all to be eliminated in a little while, and those that come after us are to benefit or are to be destroyed by the terms of this contract we write, and we ought to do it in a spirit of absolute foresight that can not be set aside for selfish reasons.

Mr. WORTHINGTON. Well, I think that no one would ever question the fairness of that statement on the one hand, and then if Mr. Ford felt that he could not undertake this within the period of fifty years, it is merely a question for the committee to decide what is the best interest of the Nation about it.

The CHAIRMAN. Yes. That is right.

Mr. WORTHINGTON. That is all you can do, and all he could expect you to do.

The CHAIRMAN. That is right, Mr. Worthington.

Mr. WORTHINGTON. One thing I would like to say—and always one sentence breeds another: There has nothing happened, I feel, Mr. Chairman, in the case of Keokuk, Hales Bar, Lock 12, or at any other dam built in any navigable stream in the United States, to support the fears or the dangers that you think may happen to the public interest in the future. I don't think there is one single thing that sustains it, and when it is true, and it will continue to be true, unless you change the Constitution of the United States or the constitutions of the States, the States themselves control the rates, why, I never have been able to understand how I could ever hesitate to let a man who would build a skyscraper for me and let him have 100 years or 150, if he let me make the rent rates.

The CHAIRMAN. But, Mr. Worthington, don't you know, in speaking of the State controlling rates, that under Mr. Ford's offer, if a contract was made carrying out that offer, it would not necessarily follow that anybody could control any of the rates down there at Muscle Shoals?

Mr. WORTHINGTON. He could not build that dam until he goes to Montgomery, before the utilities commission.

The CHAIRMAN. Exactly; but if he does nothing in the way of selling power, but simply manufactures something for himself, there is no such thing as controlling the rate there. It would not make any difference, in fact. In fact, if he does what I suspect from his representatives, he is going to do, build up a manufacturing establishment there and use, himself, the power, and not sell it, the Alabama Power Commission or any other commission has nothing to do about rates.

Mr. WORTHINGTON. Quite true; but, if he works out the problem that you described this morning of cheaper ammonia and that is distributed over the United States, it will be a very much greater contribution to the economic welfare of this country than if he never sold a kilowatt in Alabama.

The CHAIRMAN. I agree with you. That would be a great contribution, indeed.

Senator KENDRICK. I agree to that also, Mr. Worthington, but listen just a moment to this statement, if you please:

Take your suggestion a moment ago that we might possibly one day find ourselves in the position of things that will enable us to junk all this paraphernalia and start in manufacturing nitrates on what would seem a simpler and more sensible plan, that would bring the price down so that anybody could proceed to manufacture them; that is, almost any great manufacturing concern. All right. Then we might find ourselves in the position of a very foolish group of men representing the Government who had bargained away for a trifle this great power plant for a hundred years. Now, whenever we look at

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it from any angle, we see the necessity of proceeding here cautiously. I am actually prejudiced, not against Mr. Ford, but in his favor, but let me tell you, too, I am satisfied that this Nation would have been infinitely better off if we had proceeded in the way of development more slowly and more correctly than we have. I have always felt that way. Our development has been without compass and without chart in many ways. No one can now have an idea that we have been wise in our watered stock and that sort of thing, and in our railroad manipulation and building. It has been extremely unwise. It would have been better, according to my opinion, if it had not developed so fast, and had been along more sensible lines. So I think we ought to go slowly here.

Mr. WORTHINGTON. Well, Mr. Chairman, I think this, that every time we come to this great big question we are discussing here, we have to concede that you will have to take some risks, or that you have got to take up your policy, that is all there is to it. You have either got to let the Government go on and do all this and spend all the money, or you have got to take some human risks. There is no other way out.

Senator HEFLIN. It is a question of either accepting Mr. Ford's offer and taking a risk, or letting the project stand there like it has in the past.

Senator HARRELD. We could adopt a resolution today to accept Mr. Ford's offer, but that is not business.

Senator HEFLIN. Everything else he has had to do with has been business.

The CHAIRMAN. If you can guarantee that he will live a hundred years I will take a new view of the whole proposition.

Mr. WORTHINGTON. I hope, Mr. Chairman, that you will not forget that Mr. Ford sent in this proposition in June of last year.

Senator HARRELD. And he is entitled to an answer.

Mr. WORTHINGTON. And that whatever your decision is, please give him an answer as early as you can, because he can get power. He can get all the power he wants from the Queenstown-Chippewa Development, and that idea that he is trying to purloin a great power for his own use at Muscle Shoals appears to me as a wrong to him.

Senator HARRELD. Don't think I suggested that. I think he is entitled to an answer and is entitled to it soon.

STATEMENT OF MR. J. O. HAMMITT, VICE PRESIDENT AIR NITRATES CORPORATION, 511 FIFTH AVENUE, NEW YORK, N. Y.

Mr. HAMMITT. My name is J. O. Hammitt. I am vice-president of the Air Nitrates Corporation, which designed and built the Muscle Shoals nitrate plant.

Air Nitrates Corporation is a subsidiary of the American Cyanamid Co. and is entirely owned by the American Cyanamid Co., so of course the beneficiaries of any rights that Air Nitrates Corporation possesses are the stockholders of the American Cyanamid Co., and you can consider me as representing the American Cyanamid Co. as well as Air Nitrates Corporation.

I am very glad to appear before a committee some of whose members have seen the Muscle Shoals nitrate plant, because it is a little easier to justify a position of satisfaction which we feel in having put that property on the ground down there in the midst of four square miles of corn and cotton fields, without more than 20 or 25 habitable dwellings on the property, without any roads that were suitable even for automobile traffic, really suitable, and without any adequate means of bringing materials in, starting in the severest winter that had ever occurred in northern Alabama in the recollection of the oldest inhabitants, and having the plant actually in operation within nine months from the time the ground was broken. My purpose in asking an opportunity to appear before the committee is to request the committee to recognize the rights of Air Nitrates Corporation under its contract with the Government. I feel somewhat increased confidence by reason of the fact that the committee has actually seen the plant that we delivered to the Government and therefore must realize that we did actually perform, during the war, a service that was of some value.

The CHAIRMAN. You refer entirely to nitrate plant No. 2?

Mr. HAMMITT. I do; yes, sir.

The CHAIRMAN. You had nothing to do with nitrate plant No. 1?

Mr. HAMMITT. Nothing whatever, sir.

The CHAIRMAN. All right.

Mr. HAMMITT. Acceptance of the offer of Mr. Henry Ford for the acquisition by him of the nitrate plant and other property covered by his offer at

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Muscle Shoals would be a violation of the solemn obligation of the Government to Air Nitrates Corporation contained in the contract under which that plant was designed and built. I wish to invite the committee's attention to the provisions of the contract that apply. That is the principal matter that I am anxious to call to the committee's attention. I have here some printed copies of that contract which I thought it might be convenient to the committee to examine, and may I pass those around?

Article 19 of this contract relates to "Sale of plants." That is on page 17, and it reads as follows:

"*Sale of plants.*—If upon cessation of this war or for any other reason the United States determines to cease the construction, equipment, or operation of any of the said plants and to dispose of the same, the agent shall be given the first opportunity (for a reasonable period of time, not to exceed six months after receipt of written notice stating the determination of the United States to dispose of the same and the material terms upon which such disposition will be made) to purchase the same, upon as favorable terms as the United States is willing to accept, before the United States shall sell the same to any other party."

The agent referred to in that paragraph is Air Nitrates Corporation, and the plants referred to in that paragraph include United States nitrate plant No. 2, at Muscle Shoals.

The CHAIRMAN. And what else?

Mr. HAMMITT. There were two other plants the construction of which was undertaken under this contract during the war, one located at Toledo, Ohio, and one at Cincinnati, Ohio. Neither of them was completed, and both of them have been scrapped.

The CHAIRMAN. Then, for all practical purposes, in considering this contract we can go on the theory that the only plant it applies to is nitrate plant No. 2.

Mr. HAMMITT. Yes, sir.

The CHAIRMAN. That is the only reason I asked the question. I wanted to narrow it down.

Senator HEFLIN. You have no reference here to Gorgas plant at all?

Mr. HAMMITT. No, sir.

Mr. CHAIRMAN. As I understand you—your testimony and your contract and everything—the only interest you have in this hearing centers around nitrate plant No. 2 and nothing else. Is that right?

Mr. HAMMITT. That is not quite true, Senator, for this reason: Neither we nor no one else has made an offer to the Government for taking over and operating nitrate plant No. 2 without attaching to that offer some condition in the form of compensation for doing that thing. Mr. Ford's interests undoubtedly is primarily not in the nitrate plant but in the water power development. What he asks the government to do is to give him the cheapest water power on the American continent, made so cheap by reason of the fact that it is developed for him at Government expense and that he receives a lease for twice the period under which power developed at private expense can be leased or can be possessed without being subject to recapture, and on conditions by which the rental he pays for that property is a very low rate of interest on a portion of the money the Government has invested in it. That is the things that Mr. Ford would get of value to him out of his proposal, and he evidently considers that value so great that he is willing, in consideration of his receipt of that valuable thing, to make some kind of an effort, as described in his offer to operate the nitrate plant.

Now, if you cut the power end of his proposition out, he has no interest whatever in the nitrate plant. The reason he has no interest in it is the same reason that at the present time we are not prepared to make a proposal to the Government for its operation, namely, that you can not make anything at that nitrate plant now, even with cheap power, for which you could get more than approximately two-thirds of what it would cost you to make it. In other words, the operation of the nitrate plant in time of peace must be a losing operation. Mr. Ford, however, under his proposal, would receive from the United States compensation which he evidently considers is sufficient to make up all of his losses on the operation of the nitrate plant and still some more. That is the reason why we have an interest now in more than the nitrate plant itself, for we maintain that if the Government's best terms for the disposition of the nitrate plant are that they will give a water power to boot to anyone that takes it, then those are the terms which the Government must give us an opportunity to accept, under the provision of this contract.

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Senator HEFLIN. What do you think is the value of plant No. 2?

Mr. HAMMITT. I think I should state that in three different ways, Senator: I should say the replacement value of plant No. 2, first, would be roughly somewhere between one-half and three-fourths of what it cost to build that plant during the war.

I should say that the scrap value of the plant would be between 10 per cent and 15 per cent of what it cost to build that plant during the war—probably nearer to ten per cent.

Senator HEFLIN. Of the $67,000,000?

Mr. HAMMITT. If you include the steam plant. Sixty-seven million dollars includes the steam plant.

The CHAIRMAN. I have gone on the assumption that both you and Mr. Ford have included the steam plant in connection with the nitrate plant.

Mr. HAMMITT. Yes, I am including it I was just taking the $67,000,000 figure.

Yes, including the steam plant—and, of course the portion of that plant which would have the greatest salvage value would be the steam power plant—that would have an exceedingly high salvage value, and there are some costly parts of the nitrate plant which would have an exceedingly low salvage value, but I should say ten per cent would be a fair salvage value for the entire nitrate plant No. 2.

The CHAIRMAN. That would be putting nitrate plant No. 2 at about $6,700,000 then?

Mr. HAMMITT. Scrap value.

The CHAIRMAN. Scrap value.

Mr. HAMMITT. Including the quarry and steam plant.

The CHAIRMAN. That would not include Gorgas?

Mr. HAMMITT. No, sir.

The CHAIRMAN. That would not include the railroad, would it, or would it?

Mr. HAMMITT. No, sir.

The CHAIRMAN. It would not include anything down there at plant No. 2?

Mr. HAMMITT. Plant No. 1, you mean?

The CHAIRMAN. I mean plant No. 1.

Mr. HAMMITT. No, sir.

The CHAIRMAN. There is another steam plant that is to be added, is there not?

Mr. HAMMITT. Yes, sir; except that it is, of course, an uneconomical plant, I presume, because it is a very small one.

The CHAIRMAN. Of course it is small, but so far as its size is concerned it is just as modern as any other plant, is it not?

Mr. HAMMITT. I presume it is. I have not seen it Senator, but I presume it is. That, of course, does not include the transmission line which joins plant No. 1 and plant No. 2.

The CHAIRMAN. Now, then, I don't know that you intended to offer this testimony, but Senator Heflin's question has started it, and I think we ought to finish it. It applies particularly to the testimony given by Mr. Mayo as to the value.

Even the scrap value, in your judgment, of the nitrate plants, both of them, and add to it the value of the Government's interest in Gorgas and the Government's ownership of the transmission line—even the scrap value would be, I judge from your testimony, between $10,000,000 and $15,000,000, would it not?

Mr. HAMMITT. I should think so; yes, sir. I am, of course, not quite so familiar with the remainder of that property as I am with the Muscle Shoals nitrate plant; but you have added so little for the remainder, and so large a percentage of the remainder is power-plant property, whose scrap value is exceedingly high, that I should think your estimate is modest.

The CHAIRMAN. Say $15,000,000?

Mr. HAMMITT. I should think $15,000,000 would be a modest estimate.

The CHAIRMAN. A modest estimate of the value?

Mr. HAMMITT. I should say probably a fair estimate of its scrap value.

Senator HEFLIN. You are proceeding there upon the theory that the man would buy it and take it away and do what he pleased with it?

Mr. HAMMITT. Exactly; yes, sir.

The CHAIRMAN. Yes; scrap value. In other words, scrap it.

Mr. HAMMITT. Now, as to the value of United States nitrate plant No. 2 Senator, with a condition attached to it that that nitrate plant must be used in its present condition, I should say that it would have no value whatever, because you can not use that plant in its present condition or with any modification

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that would materially alter the character of the plant, for the production of anything the production of which at that plant would net you otherwise than a loss. That really is a fundamental feature of that nitrate situation that I think has had a very important effect upon the character of the bids that the Government has received.

Now, if we had conceived that the Government's desire was to place that nitrate plant in operation under conditions by which the Government would give a subsidy in one form or another that would make up the losses and turn them into a profit, if that had been our conception of what the Government wished to have done with the plant, we might have come down to Washington and made an offer; but we never had that conception and we have been unable to make any suggestion to the Government as to the operation of that plant, because we assumed that the operation would have to carry itself.

Getting back to this provision of our contract——

The CHAIRMAN. I was going to ask a question in connection with getting back to it. Now, you have just said, practically, that this plant is not worth anything if it is to be operated in time of peace. Is not that the idea you want to convey?

Mr. HAMMITT. Unless the conditions of that operation are such that they earn for the operator a compensation from the Government in some other form.

The CHAIRMAN. Well, that is getting back to the same thing. Unless you have some subsidy or are paid something outside of turning the plant over, you would not take the plant and operate it to make fertilizer unless you were paid something for doing it, even though you got all you got out of it in the sale of fertilizer?

Mr. HAMMITT. Well, if we could get all that we put into it, we would be glad to undertake the operation; but neither we nor anybody else, Senator, would be prepared to take that nitrate plant and undertake to operate that nitrate plant as a fertilizer manufacturing proposition at the present time unless the Government paid them something in some form or other for doing it.

The CHAIRMAN. In addition to what you got out of the product that you made and sold?

Mr. HAMMITT. Yes, sir.

The CHAIRMAN. That is the very thing I wanted to bring out.

Mr. HEFLIN. If Mr. Ford's offer should be accepted and he should get it at what you consider a low figure, could he afford to manufacture fertilizer?

Mr. HAMMITT. I think it is entirely possible that Mr. Ford could afford to operate that plant providing you give him water power under the terms that are contained in his offer; but I have read that offer in all its successive stages with a very great deal of care, and I am quite convinced that Mr. Ford has not said anything in his offer that actually conflicts with what he told the Secretary of War regarding the fertilizer operation, namely, that he would not operate the plant for the manufacture of fertilizer unless it could be operated at a profit.

Senator HEFLIN. He claims that he wants to make only 8 per cent profit.

The CHAIRMAN. Don't you think his proposition binds him to operate it?

Mr. HAMMITT. I do not, no, sir; and I think that whatever may be the intention regarding the fertilizer operation you can not obtain it from the offer itself, because that is in itself utterly unworkable. You will have to obtain it from some other sources of information. It is not contained in the offer. So his offer, if you would be interested, Senator, in some analysis of that fertilizer proposition——

The CHAIRMAN. Of course, we are. We should be glad to have anybody analyze any of these offers.

Senator HEFLIN. I would like, before he gets away from this matter, to call attention to this. The offer of Mr. Ford, article 15, contains this:

"The company agrees to operate nitrate plant No. 2, using the most economical source of power at the approximate present annual capacity of its machinery and equipment in the production of nitrogen and other commercial fertilizers."

Don't you think that is stated quite specifically?

Mr. HAMMITT. You have not read it all, Senator. If you will read the rest of that paragraph—and of course you have it before you, so it is not necessary to read it—you will see that that capacity——

The CHAIRMAN. Just read it, so we will all get it.

Senator HEFLIN (reading):

"(Said capacity being equal to approximately 110,000 tons of ammonium nitrate per annum), throughout the lease period, except as it may be prevented by strikes, accidents, fires or other causes beyond its control."

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And so forth.

The CHAIRMAN. Is that all you want him to read?

Mr. HAMMITT. Yes sir.

The CHAIRMAN. Does not that bind Mr. Ford? Of course it is not a contract. It is an offer. But is not that an offer to enter into a contract to operate this plant to its capacity?

Mr. HAMMITT. I think not, Senator; and the first thing that strikes me in reading that section is the definite measure that is made of the capacity of the plant.

The CHAIRMAN. Is not that correct?

Mr. HAMMITT. Only if the entire plant is operated in the production of nitrogen. In other words, you can not measure the capacity of that plant to produce phosphoric acid in terms of ammonium nitrate, because there is no phosphoric acid in ammonium nitrate. Nor can you measure the capacity of that plant to produce potash in terms of ammonium nitrate, because there is no potash in ammonium nitrate. Now, you can—although I do not think the language is well designed for the purpose—measure the capacity of that plant to produce nitrogen in terms of ammonium nitrate if what you mean—as I assume this means—is the amount of nitrogen that would be contained in 110,000 tons of ammonium nitrate. But when we are dealing in business, Senator—we never do deal in business, as a matter of fact, with hundred year contracts—but when we are dealing with long-term contracts, and we seek to write a guarantee that will actually hold during the period of a long-term contract, we must get them very definite and very specific and very clear, because our experience is that they do not last during a long term contract unless they are clear. They must be painstakingly clear, and in order that this question of a guarantee should be made painstakingly clear, the first thing you would have to have would be a statement of what it is Mr. Ford's intention to do. We have had a number of different statements on that from Mr. Ford's representatives. We have had Mr. Ford's own statement that he will not make fertilizer unless he can make it at a profit. Then we have had the statement of Mr. Mayo before the House committee to the effect that what Mr. Ford proposed to make was the equivalent of 2,000,000 tons of 2–8–2 grade of fertilizer, and that he proposed to make that at Muscle Shoals.

Well, now, if that is what he proposes to make, and he is going to use this Muscle Shoals plant in that operation, he would have to use the entire plant and the approximately 100,000 horsepower that it calls for as a power requirement, in the manufacture of only one of the three ingredients that go into that fertilizer. Then he would have to produce or purchase the other two ingredients, and if he were to produce them instead of purchasing them he would have to provide the plant facilities and equipment necessary to produce them. If he were going to produce them by use of an electric-furnace method, he would have to have for his phosphoric acid alone, in all probability, twice as much power as the total power that would be used by the Muscle Shoals plant in making nitrogen.

The CHAIRMAN. That would be about 200,000 horsepower?

Mr. HAMMITT. I should say roughly it would probably come to 200,000 horsepower, if he were going to produce phosphoric acid by an electric-furnace method.

In addition to that he would have to produce his potash. He is not even sure of having available supplies of potash in that near neighborhood. Evidently his own ideas as to how he is to get that potash are somewhat indefinite.

But it is a very difficult thing, Senator, to write a definite guarantee until you start out with a definite or clear understanding of what it is that is going to be produced. Is it going to be 2,000,000 tons of 2–8–2 fertilizer, or the equivalent in other plant foods, or is it going to be simply the nitrogen content of a 2–8–2 fertilizer, or what is it going to be?

The CHAIRMAN. To make the complete fertilizer you would have to have all three.

Mr. HAMMITT. Yes, sir.

The CHAIRMAN. Of course, this plant is equipped to make only one of them.

Mr. HAMMITT. And not even equipped to make that at the present time in a form suitable for use in fertilizer.

The CHAIRMAN. No; I understand that.

Mr. HAMMITT. But you could use a considerable portion of that plant by adding other plant facilities to it.

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The CHAIRMAN. To make the nitrogen part, now, of the fertilizer. I am interested to know whether your testimony agrees with what is before us. We have been given to understand that in amount perhaps about two-thirds of the plant now in existence, which was made, of course, for the manufacture of explosives, would be useful and would be used in the manufacture of nitrogen for fertilizer. Is that your idea?

Mr. HAMMITT. Speaking of it in value, it would be between one-half and two-thirds of the value. I think a little nearer to the half.

The CHAIRMAN. How much more machinery would have to be installed there, and what would it cost, in order to equip the plant for the manufacture of nitrogen to be used as a fertilizer ingredient? Of course, whether it be the Government or anybody else, whoever undertakes to make fertilizer, or to make the nitrogen that is to go into fertilizer, must, it is conceded, install enough machinery in addition to what is there now to do that thing. It is conceded that it can not be done just as it stands, because it was equipped to make nitrates for explosives only.

Senator HEFLIN. Mr. Chairman, I understood Major Burns to say when he exhibited some of the ingredients produced at Muscle Shoals Plant No. 2, that they were fit for use as fertilizer now.

The Chaairman. Is that right, Major?

Major BURNS. It was never my intention to convey that idea, Senator.

The CHAIRMAN. I did not get that idea from the Major's testimony.

Major BURNS. We made the finished product, ammonium nitrate, which I said was a good plant food if it could be used to make fertilizer, but it picks up so much water that as a fertilizer, at the present time, it was not acceptable as a good fertilizer material. I said the easiest way to convert No. 2 plant to a fertilizer plant was to make ammonium sulphate out of your ammonia. Ammonium sulphate is a fertilizer material. We have apparatus for the manufacture of ammonium. We have not apparatus for the manufacture of ammonium sulphate. That additional plant would have to be installed.

Senator HEFLIN. But you do make some of the ingredients now?

Major BURNS. We make the ammonia, but the ammonia is not in shape to make fertilizer.

Senator HEFLIN. The kind you make there now is not fit for fertilizer?

Major BURNS. No, sir. It is good to be put in the form of ammonium sulphate, for the manufacture of fertilizer.

The CHAIRMAN. As I understand, in making nitrates out of the air you start in just the same whether you make fertilizer or explosives, and for a certain distance you work the same way, but there comes a time before you reach the fertilizer and before you reach the explosive, if you are going to make fertilizer you go one way and if you are going to make explosive you go the other. This plant is completely equipped up to the point where the two ways separate, but from that po'nt on in order to make fertilizer you have to put in machinery to do it. Is that right?

Mr. HAMMITT. That is correct, Senator, and very clearly stated. If you were to produce your fertilizer in the form of ammonium sulphate, as Major Burns has just stated, would be the simplest manner of putting that ammonia into an available form for fertilizer use, your additional investment in plant and facilities would approximate three and one-third million dollars, assuming that you purchased your sulphuric acid instead of erecting a sulphuric acid plant to make it. The question whether you put up a sulphuric acid plant or buy your sulphuric acid would be simply the question of which would be the cheapest way to get the sulphuric acid.

Senator NORBECK. Going back to your interpretation of the Ford contract, I want to ask, it is your contention that if Mr. Ford undertook to make fertilizer and found that he could not get more than 7 per cent profit, he could then abandon the fertilizer entirely and use the power for other manufacturing purposes, entirely without any regard to the fertilizer question?

Mr. HAMMITT. I can not find out that anything very serious would happen to him if he disregarded this fertilizer-manufacturing provision of his contract entirely beyond actually making a start and discovering that the thing——

Senator NORBECK. If he made an honest effort to produce it and found that he could not make 8 per cent on the fertilizer, he could abandon the fertilizer part of it and use the power for other purposes under his contract? Is that your contention?

Mr. HAMMITT. I think there would be ways that he could accomplish that, Senator. But, frankly, my first difficulty about this fertilizer section is that

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it does not state terms that have an actual meaning. That is, it attempts to measure fertilizer in terms of ammonium nitrate, and that is an impossible way of measuring it. It does not state definitely what the intention is behind the offer.

My second difficulty about it is that there is no provision for a bond which shall be liquidated damages in behalf of the Government in case of failure to comply with this provision of the contract, such as it has been always our experience in contracts of that character everybody is required to provide. Nor is there a provision that the rights of the company acquired on the strength of this so-called guaranty shall revert in case the guaranty is not carried out, and again be taken possession of by the Government. In other words, it seems to me in the first place there is not a definite enough statement of what the capacity is that we are talking about in order to be the basis of enforcing such a guaranty, and there are not the usual sanctions in the contract in order to see that the guaranty, if definitely made, is carried out.

Senator NORBECK. The contract is not with Mr. Ford himself, but is with a corporation to be formed?

Mr. HAMMITT. Yes, sir.

Senator NORBECK. Of a comparatively low capitalization.

Mr. HAMMITT. Of a capitalization of $10,000,000.

Senator HEFLIN. Could not all those things be specifically set out in the contract that he will make if his offer is accepted?

Mr. HAMMITT. It would be perfectly possible, Senator, to draw a form of guaranty with adequate sanctions to require the manufacture of fertilizer at Muscle Shoals or anywhere else in the United States, but it is not drawn here, and you will find, all the way through, language like this: "Except as it may be prevented by strikes, accidents, fires, or other causes beyond its control."

The CHAIRMAN. There is only one clause there that would let him out, and that is "other causes beyond his control." Is that where you think the corporation could creep out?

Mr. HAMMITT. I think that is one very broad gateway out of which it might be possible to escape. I am not saying that I think there is any intention to escape, but I mean that this particular clause does not effectively accomplish the purpose which it has been said it was intended to accomplish.

Strikes, you know, Senator, are usually the result of difference between an employer and his employees. I can close up any property of the American Cyanamid Co. by a strike within two weeks if I set out with that definite purpose.

The CHAIRMAN. Yes; I suppose you could. But suppose you did it and you wanted to violate a contract by that means; do you think that the courts would permit you to do that. Suppose Mr. Ford or his company tried to get out on the fact that he had a strike and the evidence developed that the company brought the strike on purpose to get out. That would not be any defense as a matter of law, would it?

Mr. HAMMITT. Well, I am not a lawyer, Senator, but, of course, I have had some experience in the negotiation of contracts, and the only thing that impressed me was that whatever may be the intent, however definite may have been the intent to give assurance by this clause of a continuous manufacture of a fertilizer material, that intent is not successfully carried out. I think that one difficulty is that probably Mr. Ford does not know just exactly what it is he intends to do down there. The committee has heard testimony within the past two days of proposals to make fertilizer as a by-product of some other kind of an operation whose other products are mentioned as electric-furnace steel and aluminum. Now, if you have not got a definite program, or at least a definite program that you are willing should be disclosed to both parties in the outset, you will be in the very difficult position to write a definite and binding fertilizer guaranty. But if I may get back, if that serves your purpose, now, Senator——

The CHAIRMAN. Yes. All right.

Mr. HAMMITT. To the course of the testimony that I came here with the intention of presenting, I want the committee to have in mind the relations of the American Cyanamid Co. and the Government as they existed at the time that Air Nitrates Corporation, a subsidiary of the American Cyanamid Co., contracted with the Government to construct a nitrate plant at Muscle Shoals.

The American Cyanamid Co. expended a very great deal of effort and very substantial sums of money, running into millions of dollars, in the acquisition

of patents, the development of processes, the erection of plants, and the introduction into the American market of materials produced by those plants. Its operations had not been particularly profitable and they have not been specially profitable up to the present time. The company has succeeded in paying the 6 per cent cumulative dividends on its preferred stock with the exception of one quarterly payment. It has never paid a penny on its common stock. But it had these processes, it had these plants, it had a place already established at great effort and considerable expense in the American market, and it had a hope that the money that had been invested in these things might be taken out of these things ultimately with a profit.

That was the position of the American Cyanamid Co., and the most valuable thing it possessed was its knowledge and experience and processes.

The Government desired to tap a new source for nitrogen in order to eke out the necessary requirements for the conduct of the war. So the Government called upon the American Cyanamid Co. to construct a plant four times the size of the comparable plant of the American Cyanamid Co. and to operate that plant, using the processes which the American Cyanamid Co. had developed, and, of course, that plant had to be built for war purposes. If it had not been for the war needs of the Government it never would have been built. Yet it was stipulated that the plant should be built as a permanent plant, that it should be available at all times in the future, or for an indefinite period, for the manufacture of fertilizers and other products useful in times of peace. The American Cyanamid Co. requested, and the representatives of the Government agreed, that the company should have some kind of protection against that thing which it had provided for the Government during the war being used after the war for the destruction of the company which had provided it. When you consider that the largest amount of ammonia in a form produced by the cyanamid process that has ever been consumed on this side of the Atlantic Ocean by the entire fertilizer industry in any year represents not more than two-thirds of the capacity of our plant at Niagara Falls, Canada, and that the capacity of the Muscle Shoals plant is approximately four times the capacity of that Niagara plant, you may easily see what situation faced those in charge of the affairs of the American Cyanamid Co. in obtaining, while they rendered this service to the Government, protection for their stockholders against the use of the thing they provided for war purposes to destroy the investments of their stockholders. And so a certain form of protection was ultimately agreed upon which the representatives of the Government and of Air Nitrates Corporation and the American Cyanamid Co. all felt protected both the interests of the Government and the interests of the stockholders of the American Cyanamid Co. The protection was in this form, that if the Government should at any time determine to dispose of the plant it should give to Air Nitrates Corporation an opportunity to acquire that plant, not on any better terms, but on precisely the same terms as the best the Government was willing to accept from somebody else.

Senator NORBECK. You mean by that that the Government, in signing this contract, signed away from its own people the right to make cheap fertilizer in competition with you, then?

Mr. HAMMITT. No; for the Government itself can operate this plant without violation of this clause of the contract.

Senator NORBECK. Do you contend that the Government can not——

Mr. HAMMITT. The Government can not dispose of this plant to a private party to compete with us on any better terms than the Government is willing to dispose of this plant to us; but if anybody is prepared to take this plant from the Government on terms more favorable to the Government than we are willing to take the plant on, then the Government may dispose of the plant to that party on those terms.

The CHAIRMAN. Now, your contention is, as I understand it, that by virtue of this article 19 in your contract the Government must permit you to duplicate any offer made by anybody else. Is not that about it?

Mr. HAMMITT. That is one way that the thing might work out, but there are other ways.

The CHAIRMAN. Well, considering these bids, it seems to me that would be true. Suppose Congress compared these several bids we have and would say, "Well, we have decided to accept Mr. Ford's offer." Now, then, it would be necessary, before we could do that under this contract, as you contend, to give you the opportunity to take it instead of Mr. Ford?

Mr. HAMMITT. Yes, sir.

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The CHAIRMAN. And if we decided that the Alabama Power Co. had made the best offer we must give you the privilege of making the offer that they have made?

Mr. HAMMITT. Yes, sir.

The CHAIRMAN. And give you six months to decide?

Mr. HAMMITT. Giving us a reasonable time, not exceeding six months.

Senator NORBECK. I have begun to think that the Congressional committee that said that we should scrap the whole thing had the right view of it, Mr. Chairman. We don't seem to have anything.

The CHAIRMAN. There is this one road out of it. The bill I have introduced avoids this clause of the contract at least. We don't need to pay any attention to it if we pass that bill. Or at least that is the way I look at it.

Senator NORBECK. It looks this way, then, that you really gave the Government something more than they paid you for, and as a consideration the Government tied its hands in the matter of cheap fertilizer to some extent. Is that it?

Mr. HAMMITT. I could go even further than that and say that neither Air Nitrates Corporation nor the American Cyanamid Co. has received one single penny of compensation in the form of profit for the design and construction of the Muscle Shoals nitrate plant.

Senator HEFLIN. Your country was in peril at the time you came to its rescue to help furnish these nitrates. You would have been doing your patriotic duty if you did not get anything, would you not?

Senator NORBECK. You mean you got no profit out of this work, directly or indirectly, in any way, or your people—that is what you mean?

Mr. HAMMITT. Yes, sir; and I don't mean to suggest that it was not the intention when the contract was drawn that we should be compensated for the service that we rendered. This contract, like every other contract for the construction and operation of a large war plant, for the rendering of large services to the Government, did involve provisions for compensation, but the way the thing has actually worked out Air Nitrates Corporation and the American Cyanamid Co. have actually netted, on this operation, a loss.

Senator HEFLIN. You would have entered into this contract, though, even if article 19 had not been agreed to by the Government, would you not?

Mr. HAMMITT. I was not present in the negotiations which led up to the writing of this contract, and I certainly would hesitate to say that any American corporation would refuse, even to expose itself to the extent of the possible destruction of all of the investments of its stockholders, if that were necessary in order that it might render the Government a service necessary to the winning of the war; but I think it is quite clear that it would be most unjust to have asked that sacrifice of Air Nitrates Corporation and the American Cyanamid Co., and it was not asked, and this provision in this contract was inserted because this represented the kind of protection that both the representatives of the company and the representatives of the Government thought it was proper to insert.

The CHAIRMAN. I am not sure that I quite get your position that you have taken, and I want to see if I have it right.

As I understand you, your contention is that if this big plant down here owned by the Government is sold and operated and the product went into commerce, it would have a tendency to ruin your business, the business of your Canadian plant, for instance, that is doing the same kind of work?

Mr. HAMMITT. It would have that tendency; yes, sir.

The CHAIRMAN. Is that the objection you have to it, or have you any other objection except that? Would it put you out of business, to use the ordinary expression? As I understand it, the supply would be so great that would be put on the market——

Senator NORBECK. Which would result in a cheap product.

The CHAIRMAN. That it would result in putting your product down so low that it would ruin your company?

Mr. HAMMITT. It would be impossible for us to continue to make it and sell it without a heavy loss, and, of course, by the same token it would be impossible for it to be produced at Muscle Shoals and sold without a heavy loss on the Muscle Shoals operation. In fact, the loss on the Muscle Shoals operation would undoubtedly be very much heavier than our loss, yet we could not match dollars against the United States Treasury, and if the United States Treasury is put back of the Muscle Shoals operation we would be extinguished long before the United States Treasury would be extinguished.

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Senator HEFLIN. But you suggest that Ford can not succeed in making commercial fertilizer at Muscle Shoals, and if that is the case he would not be your competitor very long?

Mr. HAMMITT. If he actually guarantees to continue this operation for a hundred years, even though it be at a loss, if that be the guaranty that he is assumed to have made, then he will continue until Mr. Ford's bank account is extinguished, and we can not match dollars with Mr. Ford, so we are going to be extinguished first.

Senator HEFLIN. We are trying to get cheaper fertilizers for several million farmers in the United States, and if we can bring that about it really would not be such a serious thing for one or two concerns to be put out of business.

Mr. HAMMITT. But I maintain that it is a very serious thing to contemplate that the United States Government, having entered into an agreement on the strength of which it induced a company to expose its processes and to render a service, should thereafter disregard the obligations which it had entered into in that contract.

Now, I presume the committee is aware of the fact that the legality of this provision of the contract has been called in question by the Judge Advocate General of the Army. I did not come before this committee to argue the question of legality. I came in confidence that I might rest my case upon the public policy back of this principle, that the Government should live up to its contracts and not escape from them by reason of any legal technicality. I want to make it clear to the committee that not only do we believe that this contract is valid, but that we took all necessary precautions, in cooperation with the officers of the Government, to ascertain its legality before the protection was placed in this particular form. The question was a serious one, and at our suggestion and with the approval of the representatives of the Government, we retained Mr. Charles Evans Hughes, the present Secretary of State, to advise regarding the form in which this protection should be placed, and it was on the strength of his advice that the protection was provided in the form in which it is contained in article 19. Now, we maintain that it would be unfair, Senator, to require us to go through court proceedings in conflict with the United States Government in order to establish our right to this reasonable protection which the Government, through its contracting officers, agreed would be given to us.

Senator NORBECK. What is your investment in a plant that makes a similar product which investment you speak about being in jeopardy?

Mr. HAMMITT. Inasmuch as cyanamid is at the foundation of our entire industry, I should say investments that are threatened include everything we have except our phosphate mines in Florida, and that would run approximately 11 to 12 million dollars. As a matter of fact, it would include a portion of the investment in the phosphate mines beyond that.

Senator NORBECK. Is your plant in operation at this time?

Mr. HAMMITT. Yes. It is not operating to capacity, but it is in operation.

Senator NORBECK. Making commercial fertilizer, or the ingredients for it?

Mr. HAMMITT. Yes, sir; making cyanamid, of which we have for years been supplying the entire American requirements, and the maximum of those requirements has run up in the largest year to about 40,000 tons of cyanamid.

Senator HEFLIN. In order to get this project yourselves at Muscle Shoals, in order to keep Mr. Ford from getting it or anyone else to compete with you in the manufacture of commercial fertilizer, what is your company willing to pay to the Government for it?

Mr. HAMMITT. My company is not able to offer to take the nitrate plant from the Government on any terms that would be considered by the representatives of the Government as being at all reasonable. Neither, for that matter, is Mr. Ford, and Mr. Ford has not proposed anything of that sort, and I venture to say that if we had come to Washington and made the kind of offer that Mr. Ford made the matter would not have received favorable consideration. Upon analysis it is quite evident that Mr. Ford's interest is in the thing that Mr. Ford's organization has had experience with and understands in connection with that Muscle Shoals project, namely, power, and all the fertilizer end of the Ford offer amounts to is something that may attract sufficient support in order to make it possible for the power contract to be written.

Senator NORBECK. Do you maintain that it would be unfair for the Government to form a corporation of its own for the operation of these plants, under your contract, even though they could legally do it?

Mr. HAMMITT. Well, I have stated, Senator, that I do not consider that the Government operating the plant itself would be a violation of article 19 of

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our contract, although it would be most unfair and unwise for the Government to enter into competition with a commercial business, using that plant or using any other property on a basis on which the Government were not subjected to the same necessities of earning dividends upon their investment and paying their way that private capital is subject to earning.

Senator NORBECK. You are stating two things, first, that it is unwise, and, second, unfair. The question of wisdom would be as viewed from the point of view of the tax payer, as I understand it?

Mr. HAMMITT. Yes sir.

Senator NORBECK. In other words, you contend that the Government could not successfully do that, even though it was fair to enter into the competition. Is that it?

Mr. HAMMITT. Yes, and not only from the point of view of the benefit of the tax payer in the question of taxes, but from the point of view of the benefit to the nation as a whole in the development of industry, because I am thoroughly convinced that you must depend upon private industry for the development of the fertilizer manufacturing business as for the development of other business, and that if the Government enters into that field of industry, it will inevitably be compelled to take over the entire fertilizer industry.

The CHAIRMAN. Does the American Cyanamid Co. operate any plant except the one at Niagara Falls, Canada?

Mr. HAMMITT. Yes, sir. We have a plant at Warners, N. J., on the New Jersey side of New York Harbor.

The CHAIRMAN. What power do you use there?

Mr. HAMMITT. We use public service power, and the power consumption is exceeding small.

The CHAIRMAN. Do you use the cyanamid process, and does it not require a vast amount of power?

Mr. HAMMITT. The operations at Warners, N. J., are that part of the operations under the cyanamid process where the power requirements are exceedingly light. I suppose our entire consumption is 300 kilowatts.

The CHAIRMAN. You get the product, then, after it is partially manufactured, do you?

Mr. HAMMITT. We get it at the Warners plant in the form of cyanamid, and we ship to the Warners plant, when that plant is in operation, phosphate rock from our phosphate mines in Florida, which is another operation on which we are engaged, and we produce ammonium phosphate by processing of the phosphate rock and a subsequent processing of the ammonia and of the phosphoric acid thus produced.

The CHAIRMAN. Do you get anything out of the air in New Jersey?

Mr. HAMMITT. No, sir.

The CHAIRMAN. Where do you get the product that you take there which was originally extracted from the air, if there is any?

Mr. HAMMITT. The product that is extracted from the air is entirely produced at Niagara Falls, Canada.

The CHAIRMAN. You ship the product down to New Jersey and then finish the operation there?

Mr. HAMMITT. Yes, sir.

The CHAIRMAN. Have you any other plant except the one in Canada that takes the nitrate out of the air?

Mr. HAMMITT. No, sir.

The CHAIRMAN. That is the point I want to get at. You use your product there in making fertilizers at other plants?

Mr. HAMMITT. Yes, sir; but we produce no complete fertilizer.

The CHAIRMAN. Nowhere? Not in any of your plants?

Mr. HAMMITT. Not for use in the United States. There is possibly a use for ammonium phosphate as a complete fertilizer in foreign fields, but I mean that we are not engaged in the American fertilizer industry.

The CHAIRMAN. That is what I wanted to bring out, to see what the facts were in regard to that. Nowhere, then, in this country, are you engaged in the manufacture of a fertilizer?

Mr. HAMMITT. That is true; yes, sir.

The CHAIRMAN. Then why do you object? You are not in the fertilizer business. Why do you object to the Government or any of its assignees, like any of these bidders, using nitrate plant No. 2 at Muscle Shoals to make fertilizer? Why does that compete with your business?

Mr. HAMMITT. Because if they operate by the cyanamid process, which, by the way, if the only process by which that plant in its present condition can be

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operated, they will produce materials which are in competition in the American market with the materials which we produce at Niagara Falls, Canada.

The CHAIRMAN. You mean some by-products?

Mr. HAMMITT. No. I mean that if they produce sulphate of ammonia, for example, they will be producing a product which is in competition with our cyanamid.

The CHAIRMAN. Let us take it as it really is. It is proposed by Mr. Engstrum in his proposition and by Mr. Ford in his, that there shall be manufactured at this nitrate plant No. 2 a fertilizer, and that is what Congress wants to utilize the plant for. Just bear in mind clear through that that is what we wanted in time of peace produced at Muscle Shoals—a fertilizer. You don't produce fertilizer anywhere in America? How does it happen that this plant gets in competition with you, then?

Mr. HAMMITT. We do not—of course, if the plant were used entirely for the production of a complete fertilizer, that would mean that there would go into the American market so many tons of complete fertilizer that would be provided with their ammonia content by the Muscle Shoals nitrate plant. That tonnage of complete fertilizer would displace just so much other tonnage of complete fertilizer which, therefore, could not be manufactured, because it could not be sold, and that other tonnage which would thus be displaced would deprive us of the market for that amount of ammonia that goes into that fertilizer that can be obtained from cyanamid.

The CHAIRMAN. Then I get this idea from you. While you are not making fertilizer you are making things that other people to whom you sell put into fertilizer. Is that the idea?

Mr. HAMMITT. Yes, sir.

Senator NORBECK. Making one of the ingredients of fertilizer. That is what the fact is?

Mr. HAMMITT. That is it; yes, sir.

The CHAIRMAN. And, of course, this plant down here is going to make the same ingredient in fertilizer, is it?

Mr. HAMMITT. Yes, sir.

The CHAIRMAN. Even though they do not make a complete fertilizer.

What do you have to pay for your power up there in Canada?

Mr. HAMMITT. Without going into the details of the terms of the contract, which are rather complicated, it comes to approximately $10.50 per horsepower year.

The CHAIRMAN. Can you transpose that without difficulty into kilowatts?

Mr. HAMMITT. Yes. You divide it by seven-tenths. $15 per kilowatt year.

The CHAIRMAN. How much per kilowatt hour? That is the way we have been accustomed to figuring it.

Mr. HAMMITT. I will say parenthetically, Senator, that that is a very old power contract, and it still has some years to run, and it was written at a time when the selling price of Niagara Falls power was considerably less than it is at the present time.

Our power cost is equal to $15 per kilowatt year, or 1.7 mills per kilowatt hour. That is primary power.

The CHAIRMAN. That is the only kind you use. You buy it, don't you?

Mr. HAMMITT. Yes, sir.

The CHAIRMAN. You do not operate the power plant?

Mr. HAMMITT. Oh, no.

The CHAIRMAN. That is done by the Government, is it not?

Mr. HAMMITT. It is done now by the Canadian Hydroelectric Commission. It was done by a private company when we wrote that contract. Of course, the dam is a natural dam at Niagara.

The CHAIRMAN. That would be 1 7 mills per kilowatt hour?

Mr. HAMMITT. Yes, sir.

The CHAIRMAN. At that price for power, it is not possible, as I understand it, by means of the cyanamid process, to get nitrates out of the air and make fertilizer that will sell cheaper than the present prices of fertilizer on the American market. Is that right?

Mr. HAMMITT. If you are speaking of the Muscle Shoals plant——

The CHAIRMAN. Any plant. I am speaking of the cost of power. What I want to find out is how cheap do we have to have power in order to make fertilizer cheaper than it is made now?

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Mr. HAMMITT. Why, I think that you can find uses, certainly after a few years from now, if not now, for power as cheap as 1.7 mills to a limited quantity in the manufcture of fertilizer materials in this country, but you can not find a use by that method of the Muscle Shoals nitrate plant, because you see the Muscle Shoals nitrate plant is very limited in what it can do, in the first place, and, in the second place, it is an enormous great big plant, which is uneconomical for a very small operation, and economical only for a large operation.

The CHAIRMAN. Suppose you operated it at its capacity. Then it would be economical, would it not? We have always been told that big fellows can operate the cheapest.

Mr. HAMMITT. But you could not find a market for your product if you operated at full capacity.

The CHAIRMAN. Do you mean that if we operated the plant to its full capacity we would put so much fertilizer on the market that the farmers could not use it?

Mr. HAMMITT. Well, as a matter of fact, you can not even operate your present capacity, and will not be able to do it for years, and find a market for your fertilizer. The total amount of fertilizer sold during the past year was probably 50 per cent or less of the fertilizer producing capacity of the country, and our operation at Niagara Falls, has been, within a period of a year, curtailed even more than that.

The CHAIRMAN. Don't you think that is brought about because you charge so much for fertilizer the farmers can not buy it?

Mr. HAMMITT. Senator, that can not be true, because when your operation goes down it is not a question of how much profit you make, but it is a question of whether you lose more by keeping your plant idle or by operating your plant, and that is always the way that problem faces a manufacturing company. The company is compelled to carry in a suspense account a considerable amount of overhead charges that run along anyway whether the plant is operated or not, and if it can operate the plant and sell its product at just a little bit more than the actual manufacturing cost, exclusive of overhead, it is better off than if it kept the plant idle.

The CHAIRMAN. Yes; I can undersand that.

Mr. HAMMITT. So you will always find that when plants are down to that extent manufacturers are not at that time thinking of profit so much as they are thinking of curtailing losses.

The CHAIRMAN. I don't think that is always true, because it very often happens that the manufacturing concern can get hold of all the plants and can afford to shut down three or four of them and raise the price on the balance so high that it can make more money on them by keeping them idle than by operating them.

Mr. HAMMITT. We are not in that position, Senator.

The CHAIRMAN. I am not saying you are, but as an abstract proposition there is no doubt about that being true, and it is often done.

Mr. HAMMITT. I recognize there is really that possibility, but I was really thinking in terms of our own problem, and our own problem has been, during the past year, as I have stated.

Senator HEFLIN. How does the amount of fertilizer used in the United States in 1921 compare with 1920 and 1919? Is it not a fact that the farmer bought less fertilizer in 1921, a great deal less amount of fertilizer in 1921 than in 1920?

Mr. HAMMITT. That is quite true, Senator, but it is also true that the fertilizer-producing capacity of the United States is approximately 10,000,000 tons a year, and the largest amount of fertilizer which the American farmers have ever purchased in any year is approximately 7,500,000 tons.

Senator HEFLIN. But don't you suppose if the price of fertilizer was cheaper they would consume a great deal more?

Mr. HAMMITT. I think that while that may not, perhaps, have been true during the past year, ultimately there would be an increase in the consumption of fertilizer with a reduction in the price.

Senator HEFLIN. Oh, yes; I think so.

The CHAIRMAN. We will adjourn until 2.30, and we will meet in the Commerce Committee room on the gallery floor of the Senate.

(At 1.15 o'clock p. m. a recess was taken to 2.30 o'clock p. m.)

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AFTER RECESS.

The committee reconvened at 2.30 o'clock p. m.

STATEMENT OF MR. J. O. HAMMITT.—Resumed.

The CHAIRMAN. All right, you may proceed, Mr. Hammitt.

Mr. HAMMITT. I think, Senator, I have completed the statement that I wished to make.

The CHAIRMAN. This contract is in the record, and I think it was put in by Major Burns. [Addressing Major Burns.] Major, in your testimony, did you put this contract in the record?

Major BURNS. Yes, sir.

The CHAIRMAN. I have not examined it closely, but I think there is a place in it where your company gets a royalty, is there not, for everything that is made there? [Addressing Mr. Mammitt.]

Mr. HAMMITT. Everything that is made with the use of the cyanamid patents. That is in the license agreement, which is made a part of the contract, and there are two provisions relating to royalties. One you will find on page 27. That is article 6.

The CHAIRMAN. Yes; that is the one I am looking at now.

Mr. HAMMITT. There is another one also.

The CHAIRMAN. Yes.

Mr. HAMMITT. The other one is on page 29, article 10.

The CHAIRMAN. Yes; it is a part of article 10. Does not that compensate you for the use of your patents, or is not that the idea of it?

Mr. HAMMITT. That is intended to be compensation for the use of our patents. Of course, it is a part of a contract that provided protection for the American Cyanamid Co. and its subsidiary, Air Nitrates Corporation, in several different ways, and one of the forms of protection that are afforded is contained in these provisions regarding royalties.

The CHAIRMAN. Neither the Government nor anyone else, under this contract, could make anything without paying you a royalty, could they?

Mr. HAMMITT. Unless they operated without the use of any of the cyanamid patents. The only reason I mention that is because of Mr. Mayo's testimony, because, within our knowledge, there is no way the plant can be operated without making use of those patents.

The CHAIRMAN. Then, how are you going to be hurt if the Government or anybody else operates the plant?

Mr. HAMMITT. We do not consider that these royalties constitute complete compensation or satisfactory compensation for the injury that would be done to us if this plant were taken over from the Government by some one else on terms so favorable as to make it possible for them to produce and place the product on the market.

The CHAIRMAN. Well, your objection is not that you are not getting paid, but that somebody else is going to get too much? Does it not simmer down to that?

Mr. HAMMITT. No; our objection is that the amount that would be paid would not be adequate compensation for the injury that would be done to us.

The CHAIRMAN. What was the object of putting these royalties in then?

Senator NORBECK. And you have not been operating at a profit, have you?

Mr. HAMMITT. Yes; we have been operating at a profit. The American Cyanamid Co., as I testified this morning, has paid 6 per cent cumulative dividends on its preferred stock, with the exception of one quarterly payment. It has not paid anything on its common stock. Of course, it is the hope of the stockholders of the company that it will ultimately be possible to pay dividends on the common stock, and it is quite commonly the case that in a manufacturing operation which breaks into new fields, as the American Cyanamid Co. did, the earlier years of the operation are not profitable years.

I should like to say this Senator, regarding this aspect of the case, that the whole theory of the patent law, of course, is to encourage invention, and the encouragement of invention is extended under the general patent law not in the form of provision that anybody who obtains a patent shall be paid a royalty by anybody who operates under the patent, but in the form that anybody who obtains a patent shall have, during a certain period of years, the exclusive right to the use of the patent.

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The CHAIRMAN. To give him a monopoly of it, in other words.

Mr. HAMMITT. Absolutely.

The CHAIRMAN. Yes.

Mr. HAMMITT. That is the theory of the patent law. Now, when we came to the negotiation of this contract with the Government it was agreed on both sides that a royalty should be paid by the Government in case it operated, or by any assignee of the Government in case it should operate, the plant; but that in addition to that we should have protection against the virtually compulsory licensing of another operator under our patents. This is what this would amount to if we did not have some such provision as is contained in article 19. It is a matter of business judgment, of course, whether a royalty provision is adequate protection for the stockholders of the American Cyanamid Co. It is not the full extent of the protection that is given to us under this contract, and it is our business judgment that it is not adequate protection.

The CHAIRMAN. Well, of course, the getting of a royalty is not as good as the getting a monopoly; everybody will concede that, but you made this contract and provided for a royalty.

Mr. HAMMITT. Yes, sir; and it was provided that we should have first chance to buy the plant unless some one else is prepared to take that property from the United States on terms more favorable to the United States than we are prepared to take that property on.

Senator HEFLIN. I understood you to state this morning that you were not prepared to take it at all; that you were not able to bid an adequate price.

Mr. HAMMITT. I did not mean to convey that impression at all, Senator. The impression I meant to convey was that we would not be prepared at this time to take the nitrate plant and operate it unless you attach to that nitrate plant, as you do in the offer of Mr. Ford, something else of value.

The CHAIRMAN. Let us get at it in this way: Are you prepared to take the offer of Mr. Ford? Are you prepared to comply with his proposition?

Mr. HAMMITT. I have not the least question, Senator, that if this property is offered to us on the terms contained in the Ford offer it will be accepted, and the only reason I state it that way instead of saying yes is, of course, because I can not definitely speak for the board of directors of Air Nitrates Corporation or of the American Cyanamid Co.; but I will say that I certainly would recommend it, and I will say I have not the slightest doubt that it would be accepted, and it will not take any six months to determine whether it should be accepted or not.

Senator HEFLIN. Now, right in that connection, you stated this morning that in your judgment if Mr. Ford complied with the contract and undertook to manufacture fertilizer there he would go broke. You now say you would accept his offer and do what he proposes to do.

Mr. HAMMITT. I did not mean there to convey the impression that if Mr. Ford continued under that particular contract he would go broke. What I meant to convey is—and I think you will find that this is really the extent of my testimony, Senator—that anyone who attempted to operate that plant, relying solely on the operation of that plant for his profits, would lose money, and lose money very rapidly, at any rate, if he operated to capacity. Ultimately Mr. Ford, or anybody else, would go broke on that kind of an operation; but that is not what is contemplated in Mr. Ford's proposition. The principal part of Mr. Ford's proposition relates not to the nitrate plant at all, but to the water power, and in the form of a Government-financed water power granted to him under a 100-year lease Mr. Ford gets something of such great value that it would doubtless make up all of his losses on the operation of the nitrate plant.

The CHAIRMAN. Now, let us take another proposition. Suppose the committee decided that they were going to accept Mr. Engstrum's proposition. Are you willing to do that?

Mr. HAMMITT. I will have to confess that I have not studied Mr. Engstrum's proposition with the same care that I have studied that of Mr. Ford, because a first reading of it indicated that, in substance, it was a cost-plus contract, upon which the funds were to be advanced by the United States, and the compensation would have to be entirely independent of any risk on the part of the company; but, with that qualification, I will say that I have no more doubt that we would accept the Engstrum proposition than that we would accept the Ford proposition.

The CHAIRMAN. How about the Alabama Power Co. proposition?

Mr. HAMMITT. The Alabama Power Co. proposition involves the taking of only a relatively small portion of the nitrate plant, of course, namely, the power

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plant, and I think I would have to give some further study to that question before I would be justified in saying to you that we would accept that proposition if it were offered to us. I do not want to say that we would not accept it; but I do not want to make as strong a statement of conviction that we would accept it, regarding that offer as I have made regarding the others. Of course that is a power proposition, pure and simple. The American Cyanamid Co. is not at the present time in the power business.

The CHAIRMAN. Well, of course, you could not accept any of these propositions without going into the power business.

Mr. HAMMITT. We could not, of course.

The CHAIRMAN. To quite an extent, at least.

Mr. HAMMITT. But if, for example, the Ford proposition was to be the basis of the turning over of that nitrate proposition, I am sure that we could not afford not to go into the power business.

The CHAIRMAN. We still have another proposition. Have you considered Parsons's proposition? The committee has not taken it up yet. It just came in a little while ago.

Mr. HAMMITT. I think I have read every one of these propositions at least once, and those that I considered most serious I studied carefully, namely, the Ford proposition, and the Alabama Power Co. proposition.

The CHAIRMAN. As between the Ford proposition and the Alabama Power Co. proposition and the Engstrum proposition, which one would you rather have?

Mr. HAMMITT. We would, in my judgment, very much rather have the Ford proposition.

The CHAIRMAN. You think that is better for whoever gets it, the Ford proposition has a greater opportunity to make a profit than any of the others?

Mr. HAMMITT. That is my judgment; yes, sir; and if you wish me to state which one is in the second place, I would say——

The CHAIRMAN. Yes.

Mr. HAMMITT. The Engstrum proposition.

The CHAIRMAN. The Engstrum proposition?

Mr. HAMMITT. Yes.

The CHAIRMAN. You would take that before you would take the Alabama Power Co. proposition?

Mr. HAMMITT. That is my judgment; yes, sir.

The CHAIRMAN. Then, your judgment as to all of these offers, from the point of view of the person who is getting them, would be first Ford, next Engstrum, and next the Alabama Power Co. proposition?

Mr. HAMMITT. Yes, sir.

The CHAIRMAN. Arguing now for the benefit of the Government, would it follow that, acting on behalf of the Government, we should better take them in the inverse order? That may not, considering now the interests of the Government instead of the person who is going to get the property, the Alabama Power Co. proposition is the best one from the Government standpoint?

Mr. HAMMITT. I would say, without question, that it is, Senator; but I would not recommend that the Government accept the Alabama Power Co. proposition. If I were in the position of the Government I believe I would trade better on that water power than the Alabama Power Co. proposition.

The CHAIRMAN. You think the Government, then, is in shape to get a better proposition than anybody has offered?

Mr. HAMMITT. I do, if the Government will separate——

The CHAIRMAN. Why did you not make such a proposition?

Mr. HAMMITT (continuing). If the Government will separate the water power from the nitrate property and offer each of these separate branches of that project for development, it will be able to obtain, in my judgment, for the development of the water power a proposition even better than the proposition that the Alabama Power Co. has made to the Government, although that very much more nearly approaches the kind of a contract that, in my personal judgment, the Government should write, than any of the other offers that have been made; but I think the Government under those circumstances, would not receive any offer for the nitrate plant that the Government would be justified in considering.

The CHAIRMAN. Well, you think we would have to couple them up in order to get anybody to take the nitrate plant?

Mr. HAMMITT. I do; but I do not think you ought to pay that price in order to get anybody to take the nitrate plant, Senator. I will say that if you do not

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couple them up you could, no doubt, get somebody to take the nitrate plant by paying him in cash or in some other thing of value the price which Mr. Ford asks you to pay in the form of water power. That is the inducement to Mr. Ford to take the nitrate plant, but I presume that inducement could be put in some other form than water power.

The CHAIRMAN. Had you negotiated at all with the Government with regard to taking over the nitrate plant under your contract?

Mr. HAMMITT. No; we have discussed with the representatives of the Government a great many times the question of possible uses of the nitrate plant, and always with a view to ultimately developing a manufacturing program for the nitrate plant that would make a commercial operation possible. But we have not at any time succeeded in developing such a manufacturing program, and it is our judgment that nobody else has; and, furthermore, that we will probably realize our hopes of being the first ever to develop such a program. That is not illogical, because we have had more experience in the operation of the processes for which that plant was designed than any other organization.

The CHAIRMAN. First, let me ask you: Have you any interest in the so-called Haber process?

Mr. HAMMITT. No, sir.

The CHAIRMAN. Is not that a newer process and a cheaper one?

Mr. HAMMITT. The question of whether the Haber process is cheaper or more expensive doubtless depends upon the location of the plant that is operating one or the other process and upon a number of different facts, so that it is entirely possible and, as a matter of fact undoubtedly is true, that in some cases the Haber process is more adaptable to the conditions, and in some cases the cyanamid process is more adaptable.

The CHAIRMAN. Well, take them as they are down there, then what?

Mr. HAMMITT. I do not want to attempt to qualify as an expert on the Haber process, but I think it entirely possible that, with equally efficient plants located at Muscle Shoals, there might be just as much likelihood of a place for one process as for the other.

Your Haber operation is very much handicapped in this country, however, by reason of the fact that, at any rate, as it is operated in Germany it requires a very high grade of labor from the point of view of technical training, and that labor is not available in this country at low wage rates. The cyanamid process uses for most of its employees what you might call semiskilled labor—furnace men, men who are inured to a certain kind of operation and somewhat specially trained in a certain kind of repetitious work, but it is a class of labor that in the Muscle Shoals district it would be very easy to obtain, and I think the class of labor that would be required for the operation of the Haber plant would be more difficult to obtain. On the other hand, there are relative advantages and disadvantages that might be balanced off one against the other, with a possibility of reaching a different result and making the Haber operation at Muscle Shoals more successful than the cyanamid operation at Muscle Shoals.

The CHAIRMAN. Among scientific men and among experts, is not the Haber process considered one that is most promising now?

Mr. HAMMITT. I think there is a very wide difference of opinion among scientific men. I would hesitate to say that the weight of opinion was on either side, Senator.

The CHAIRMAN. Well, it is a newer process, is it not?

Mr. HAMMITT. Yes; it is a newer process, but the two are both of them relatively so new that the possibility of the development——

The CHAIRMAN. Germany has been using both processes, has she not?

Mr. HAMMITT. She has; yes, sir.

The CHAIRMAN. And is using them both now, is she not?

Mr. HAMMITT. Yes, sir.

The CHAIRMAN. Is she making a fertilizer now by the cyanamid process?

Mr. HAMMITT. Yes, sir.

The CHAIRMAN. And she uses steam power to do it, does she not?

Mr. HAMMITT. She is operating a cyanamid process under steam power; yes, sir. I am not sufficiently familiar with the present conditions in Germany as to costs of operation to be able to analyze that German situation for you successfully. You must remember that in Germany every economic factor at the present time is turned upside down. Germany is employing labor at less than the amount of money it costs the labor to live, and is making up the difference by giving food subsidies at the cost of the Government.

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The CHAIRMAN. The big question in the cyanamid process is the power, is it not? That is the biggest item in the thing, is it not?

Mr. HAMMITT. No; I would not say that that was the biggest. The labor item is a very heavy item in the cyanamid process.

The CHAIRMAN. How it is that Germany can afford to manufacture under the cyanamid process, or the other one, for that matter, in times of peace, without any cheap power, and make fertilizer, when we, with our power, as you say, the cheapest power in the world, are not able to do it and sell fertilizer at a reasonable price?

Mr. HAMMITT. I said of this particular power under the Ford proposition it would be the cheapest power on the American Continent, but, of course, I meant to Mr. Ford. I did not mean it would be the cheapest of development. He would get it at less than the cost of development.

The CHAIRMAN. Well, take the power that you get at Niagara Falls.

Mr. HAMMITT. That is exceedingly cheap power; but I have before me a set of figures that were submitted by the nitrate director of the Ordnance Department at the hearings before this same committee a year ago, and those figures, as to manufacturing costs, are at least relatively correct.

These figures give the cost of producing a ton of sulphate of ammonia, under a certain assumption, at $48.19, and, under a certain other assumption at $58.70. Now, the difference between the first assumption and the second assumption is entirely in the power. That is, under the first assumption, the power is figured at three-fourths of a mill per kilowatt hour, and, under the second assumption, the power is figured at 4 mills per kilowatt hour; so that the difference between the three-fourths of a mill and the 4 mills, namely, 3¼ mills per kilowatt hour, is the difference between $48.19 and $58.70, or just about $10 per ton of sulphate of ammonia produced by the cyanamid process. Now, that $10 per ton represents an increase of 3¼ mills—let us say for purposes of easy calculation, 4 mills—in the cost of power. That would be $2.50 per ton for every mill increase in the cost of power. The actual cost of power in this item of $48.19 for sulphate of ammonia was $2.10. That was the power cost as submitted by the Ordnance Department, and under the higher rate for power the power cost, out of a total cost of $59.13, was $11.23. So that you see in one case the power represented about 4 per cent of the cost of the sulphate of ammonia, and in the other case, the power represented about 20 per cent.

The CHAIRMAN. All of the other conditions were the same as these examples, were they?

Mr. HAMMITT. Well, I have incorrectly stated that in actual figures, because I have taken the power cost per ton of lime nitrogen, and used that for the power cost per ton of sulphate of ammonia, but the fraction of difference between the two is so small that these percentages that I have stated would not be affected by it. In other words, the power consumption is practically entirely in the manufacture of the lime nitrogen. What I mean to convey by that, Senator, is not that the power is not a very important factor, as it quite obviously is, in the cost of production, and I do not mean to convey either that the difference between cheap power and expensive power may not make all the difference between a successful and an unsuccessful operation, because you are dealing principally with very close margins as between a successful and an unsuccessful operation, but I do not want to give testimony that would create the impression that the largest item of cost is necessarily power.

Senator NORBECK. The point is this, that even with free power there would not be a great reduction in the cost of the product; is that it?

Mr. HAMMITT. Well, as against three-fourths of a mill power per kilowatt hour, that reduction would be $2.10 per ton of lime nitrogen, and substantially that per ton sulphate of ammonia. In the case of the 4-mill power, it would be $11.22 per ton of lime nitrogen and substantially that per ton of sulphate of ammonia. These figures submitted by the Ordnance Department are based upon the actual test runs that were made in the Muscle Shoals nitrate plant, and are quite competently computed.

The CHAIRMAN. Now, according to your idea, as I understand it, the only value of the nitrate plant is to let it stand there, to be kept in condition to be used in case of war.

Mr. HAMMITT. I think that is the best disposition that can be made of that nitrate plant until such time as, by reason of changes in market conditions or advancements or new discoveries in the art of manufacture, it is possible to prepare a manufacturing program for the plant that would give a promise of

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paying out; but even though it were necessary to keep that plant in a stand-by condition indefinitely. Senator, I think that this committee and the Congress might justify all the expenditures made for that purpose, which amount to exceedingly little in comparison with the expenditures which are made and appropriated annually for very much less important measures of preparedness, and that nitrate plant, in a stand-by condition, would, in my judgment, be a better preparedness asset than that plant in operation. That is, if the edict of Congress should be that the plant should never be operated in times of peace, it would, in my judgment, be a better preparedness item than if it should be operated during peace times for the manufacture of peace-time products. I am very much impressed and inclined toward that view by the experiences that we had during the war, when what we needed was not a plant with a capacity to produce nitrates, but something with a capacity to produce more nitrates than the country had been in the habit during peace times of consuming. If you keep your plant in idleness, you will have other plants developed to supply the peace-time needs, and you will also have a reserve of capacity that can be utilized in time of war. I would not recommend keeping the plant indefinitely in idleness, because I think that the preparedness feature of the problem must be subordinated to other features of the problem, but what I mean to convey is that, purely from a preparedness point of view, that plant would be worth even more in idleness than in operation, and therefore, if you are compelled during a period of years to maintain it in idleness, I think Congress should feel justified in making the necessary appropriations for that purpose.

The CHAIRMAN. Then, we would have to maintain dams? You would not want to abandon them, would you?

Mr. HAMMITT. My recommendation regarding the water power dams, inasmuch as the Government unwisely, I believe, has already expended $17,000,000 in construction work down there——

The CHAIRMAN. What do you mean by "unwisely"?

Mr. HAMMITT. I mean the money was spent at the very highest prices of labor and materials that we have ever experienced in this country.

The CHAIRMAN. Well, was the Government to blame for that? How could it help it?

Mr. HAMMITT. The Government might have waited, inasmuch as there was no war emergency involved in the construction of that dam. All of the money was spent, with the exception of a very few thousands of dollars, after the armistice had been signed, and the Government could have waited, and I think should have waited, until there were cheaper labor and material rates. That is the only criticism that I wish to offer of that program; but since the Government has spent that money, it is my judgment that the wise thing to do with that water power project is to relieve it of the restrictions existing in the law, and then make it possible for that water power to be developed under the provisions of the Federal water power act. If you do that, I am thoroughly satisfied that you can have that water power developed and placed in operation without the expenditure of another penny of the Government's money on it. In addition to that, you would receive an actual return, not in the form of secondary power, or of any indefinite thing, but, in my opinion, you could negotiate a return in the form of actual cash compensation to the Government for expenditures that the Government has already made.

The CHAIRMAN. By leasing it to some one.

Mr. HAMMITT. By issuing a license to some one under the Federal water power act to complete it at its own expense and selling to that party the Government's uncompleted structure and its construction equipment on the job.

The CHAIRMAN. Then, of course, if the Government went to war, in order to obtain the power, it would have to buy it, or condemn it and take it and pay for it. In that event, it would subject itself to a very large amount of damages. It would not be only the value of the property, but if the owner or lessee had made the contracts, as is very likely, running over a term of years, with various corporations and municipalities and other who wanted to buy the power, and if the Government took it over and broke all of those contracts, it would have to pay damages for each one of them, of course?

Mr. HAMMITT. There are two matters that ought to be considered in that connection, Senator. In the first place, there is plenty of power at Muscle Shoals now for the operation of the nitrate plant, and if you wished to emphasize the national defense aspect of the problem to the extent of providing your-

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self with the very best preparedness, you would keep in standby condition not only the nitrate chemical plant proper, but also the steam power plant that is connected with it, and that steam power plant, while the power would be expensive, nevertheless, would be capable of operating the nitrate plant to its full capacity in times of war, and you could turn it over immediately. The second thing I think you should have in mind in connection with that thought is that the Federal power act itself contains provisions under which the Government can take over the power in times of emergency. Just exactly what those provisions are I can not state.

The CHAIRMAN. Of course, it could do it without those provisions, but it would have to pay damages, and it ought to pay them.

Mr. HAMMITT. Yes; but I think, under the Federal water power act, there are some special guaranties that would make it simpler and less expensive for the Government to take it.

The CHAIRMAN. Well, I do not know how the Government could take it without paying damages, which, I can see, might be very high. Of course, it could do that. Then we would have, if your idea was carried out, that entire plant there, including the steam plant and everything, just kept in idleness in times of peace, to be prepared in time of war.

Mr. HAMMITT. Yes; but, understand, I would not recommend that as a policy to be continued after there has been developed some program for operating the plant that gave promise of being commercially successful, and you can arrange for that automatically to settle itself, because just as soon as anybody has developed a program for the operation of that plant, that they have reason to believe will be commercially successful, they will be prepared to negotiate with the Government for purchasing the plant.

The CHAIRMAN. Suppose they did that, the next thing they would do would be to put you out of business, and that would be just the same as if the Government put you out.

Mr. HAMMITT. It would be about the same in its effect, but we could not protest against that with any such grace, it seems to me, as we could protest against the Government violating its conract obligations with us and against the Government itself competing on an unfair basis against us; but if anyone can develop a manufacturing program that will succeed where we can not develop a manufacturing program that will succeed, then we certainly can not raise any protest against their putting us out of business.

The CHAIRMAN. Don't you think that if the Government operated it itself, it would improve the process the same as you probably will in your operations? I suppose you are looking towards improvements in it all the time, and is it not generally expected, since this is in its infancy, to a great extent, at least, that it is going to be improved and cheapened?

Mr. HAMMITT. I think no doubt that is true, and yet——

The CHAIRMAN. If the Government did it on its own initiative, it would avoid getting into the trouble that it seems to be in now with you, because if any private individual does it the first thing they would do is to patent it, and that means that the Government can not use it without the consent of the person getting the patent.

Mr. HAMMITT. Well, Senator, in order to get the benefit of all possible improvements it will not be necessary for the Government or anybody else to enter into a ruinously expensive operation of a plant of that size.

The CHAIRMAN. That is the only plant that the Government has? It has not any smaller plant?

Mr. HAMMITT. No; but it would be much cheaper for the Government, if it intended to carry on an experimental operation, even to go to the extent of building a separate plant to conduct it.

The CHAIRMAN. Well, that might be.

Mr. HAMMITT. Rather than to operate a plant of the size of that one at Muscle Shoals, and these improvements in the art, the real substantial fundamental ones, come as the result of a great deal of research, such research as the Government not only is capable of carrying out, but at the present time is actually engaged in carrying out under appropriations made under the provisions of the national defense act.

The CHAIRMAN. Well, has it not been the experience in connection with most improvements of this kind that necessity has brought them about? Take the matter of flying machines. Great improvements were made along that line during the war because they were necessary.

Mr. HAMMITT. Yes, Senator; but you must remember——

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The CHAIRMAN. Now, is it not necessary to do something by way of giving to agriculture cheaper fertilizer? Do not all the people who depend upon the use of the products of agriculture almost of necessity have to have some cheaper way of getting them to the consumer?

Mr. HAMMITT. I would say that that is extremely desirable. I do not think we have reached the point where you can describe it as a necessity; certainly not in the sense——

The CHAIRMAN. Well, the soil is wearing out; we are not getting the kind of fertilizer that we ought to have, especially in the East and South. I think that is conceded, and it is also claimed that it costs too much.

Mr. HAMMITT. There is not any doubt that the price at which fertilizer can be sold has an important bearing upon the amount of fertilizer that is consumed.

The CHAIRMAN. Yes.

Mr. HAMMITT. But there are several other things that have such a bearing, and one of those things is the price at which the farm product is sold.

The CHAIRMAN. Now, do you think the Government of the United States is under any obligation to stay out of this fertilizer business for the benefit of its people simply because it might injure a corporation over in Canada that is dealing in the same product?

Mr. HAMMITT. Oh, no.

The CHAIRMAN. Even though it does give up money outside of what is necessary to operate it, and even though it does keep it up by means of a subsidy, regardless of whether that is a right thing as a governmental policy or a wrong thing? Has it not a perfect right to do that?

Mr. HAMMITT. I think when you speak of the Government operating this directly by itself, the Government is under no obligation not to do that. I believe the Government is under an obligation not to extend a subsidy to anyone else to operate this nitrate plant without first, under the terms of our contract with the Government, having offered that subsidy to us.

The CHAIRMAN. Of course, that is entirely a question of law, if that is valid, and I understand that is to be argued here. I do not know whether you are going to have anybody to argue it or not before the committee.

Mr. HAMMITT. No. As a matter of fact, Senator, we have felt that we ought not be put to the necessity of arguing that question as a legal question, because it has seemed quite clear to us the public policy, such as the committee would sustain, would be in favor of the Government living up to its written obligations, irrespective of whether those obligations might, by technicality, be held to be not legally binding.

The CHAIRMAN. I think there would be that kind of feeling with most people, if the contract were entered into without any shade of coercion having been used, or anything of that kind, if you did not take advantage of the Government wanting to do something, and if the contract was fair. I do not think that anyone wants to stand on legal technicalities, but is this one of the things that has been passed on by the lawyers of the War Department? Is this one of the things that they have said are null and void?

Mr. HAMMITT. There was not any opinion renderd by the Judge Advocate General on this particular contract, but a memorandum of the Judge Advocate General, which is included in the papers submitted to this committee by the Secretary of War, indicates that the Judge Advocate General would hold the same opinion regarding this contract that he holds regarding the Alabama Power Co. contract.

The CHAIRMAN. And he held that to be illegal?

Mr. HAMMITT. And he held that provision in the Alabama Power Co. contract to be invalid. Of course, we know that if the American Cyanamid Co. after entering into a contract in the course of its business operations, then sought to escape from a perfectly plain provision of the contract on the ground that it was invalid, very shortly it would be impossible for us to do business successfully in the United States, because nobody would want to deal with us, and if they did deal with us, they would deal with us only at arms' length.

The CHAIRMAN. Well, is not that true of most of us? In the run of business, corporations and individuals take advantage of every technicality they can in a contract, do they not?

Mr. HAMMITT. Quite to the contrary, Senator, and if any corporation does that——

The CHAIRMAN. Well, if you are right in that, the courts are fooling us, because they are trying lawsuits and arguing these technicalities, and those matters should be taken before a jury of Sunday school superintendents instead of having the courts pass upon them.

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Mr. HAMMITT. Well, you would be astonished, Senator, at the relationship between the number of cases that might be brought to the courts and are not taken to the courts, and the number of cases that actually do get into the courts.

The CHAIRMAN. Is it not true that every one of these corporations has its lawyers employed by the year, and their duty is to keep them out of the courts sometimes by studying these technicalities and telling them in advance whether they had better go into the courts or not?

Mr. HAMMITT. That, of course——

The CHAIRMAN (interposing). You stay out of the courts not because you are not technical, but because you are, and you are able to tell in advance whether you stand any showing if you get into the courts.

Mr. HAMMITT. That is a precaution which, in writing contracts, corporations necessarily take, but it is not considered the usual and customary method of American business to attempt to escape from the provisions of a contract, because after the contract was written somebody has discovered they had not written it in a form that would be legally binding.

The CHAIRMAN. Let us take my definition and go back to your discussion of Mr. Ford's proposition. Your objection there was that there was just that kind of thing that might let Mr. Ford out, and if your definition of the business that the corporation that he has organized is going to run for 100 years is correct, it would not make any difference whether they can get out under that or not. They would say, "We offer to run it, and we are going to do so to full capacity; we do not care what the contract is."

Mr. HAMMITT. I was not trying to state, of course, my own objections, but to express my personal views for whatever value they might have to the committee.

The CHAIRMAN. And I was very glad to get your views.

Mr. HAMMITT. And what worried me about that or rather what I thought should worry you, Senator, regarding that Ford contract, was very largely the fact that there was absolutely nothing in the record or in the contract that plainly expressed precisely what it was Mr. Ford's intention to do.

The CHAIRMAN. I was very glad you went into that. You caused me to think a great deal about the representations that were made here. There is no doubt but what Mr. Ford's representatives have stated here and have left the impression here with this committee and with everybody, I think, that they are bound by their bid to operate that nitrate plant to its capacity. Of course, the particular technical phrases used there of the chemical that they are going to make might be, as you say, not as we understood it, but I am satisfied that we all got the same understanding, and would get it from a reading of it, although I can see from your explanation that you are right about the terms used. I do not understand them, and it would probably take a chemist to explain them. You might be right, and I was very glad to get your testimony on that.

Senator HEFLIN. Mr. Mayo, the chief engineer for Mr. Ford, testified, Mr. Chairman, that it was Mr. Ford's intention to use this 100,000 horsepower for manufacturing fertilizers.

The CHAIRMAN. Well, he was going to run this plant to capacity.

Senator HEFLIN. That he intended to use more horsepower than was set out in the contract

The CHAIRMAN. Yes.

Mr. HAMMITT. That is a very different situation which will face this company long after those who participated in the making of the contract have passed away than it would be if in the contract itself, as in this contract of ours, there were plainly written down precisely what the parties to the contract believed they were agreeing upon, and the question comes up at a time when everybody who had anything to do with the negotiation of our contract on either side is available to the committee, and will undoubtedly tell the committee what was intended when that provision was written there.

The CHAIRMAN. Well, the universal law is that a contract, which is plain on its face, can not be explained by testimony of that kind. It is only when there is a doubt as to what the contract means that you can go back to find out what was meant by it.

Mr. HAMMITT. Here is a case where nobody raises any question. The only question of the Judge Advocate General is whether those who wrote that contract on behalf of the Government had authority to do so.

The CHAIRMAN. I suppose that is it. I do not know. I have not read his opinion.

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Mr. HAMMITT. And, furthermore, in the case of Mr. Ford's contract, I should think the committee would be very much concerned by the fact that Mr. Ford's own statement regarding his intentions and the statements of his representatives before two committees of Congress differ so widely as to the intentions with regard to the manufacture of fertilizer and as to the intentions in regard to a thing which I will say to the committee is perfectly simple to write in the form of a definite and binding guaranty, providing you are first told exactly what it is you want to have guaranteed.

Senator HEFLIN. In the face of his contracts and the statements of his representatives here about the manufacture of fertilizer, there would not be any trouble about writing the right sort of a contract, if his offer is accepted, would there?

Mr. HAMMITT. If you are perfectly clear in your mind as to what it is he guarantees to do, I am sure you could write it into a contract; but if you do not know whether what he means is what Mr. Ford says to the Secretary of War, namely, "I will make fertilizer so long as it is profitable," or whether what he means is what Mr. Mayo says to the House committee, namely, "I will make the equivalent of 2,000,000 tons of 2–8–2 fertilizer," that is another thing again, or whether what he means is what Mr. Mayo testified to before this committee within the last two days, namely, that they have got a manufacturing operation that involves the manufacture of electric furnace steel and aluminum and working the fertilizer as a by-product, that is still another thing again. If you do not know which one of those different things that have been from time to time offered as being the intentions of Mr. Ford, are the things that actually represent his intentions, I should think you would have some difficulty in writing a guaranty.

Senator HEFLIN. I have one other question right there, Mr. Chairman.

You set out here in article 19 of your contract with the Government that if the Government shall cease this construction work at Muscle Shoals, and if it desires to dispose of this project it should give you the first opportunity to purchase it. When was this work stopped down there?

Major Burns, can you tell us that?

Major BURNS. The construction was finished in the latter part of December, 1918, I should say—December or January.

Senator HEFLIN. Yes; but when was the work on the dam stopped? When did that cease?

Major BURNS. We carried that on until, I think, about the last of May a year ago, when the appropriation about ran out.

Senator HEFLIN. And the work has been stopped for a year?

Major BURNS. Just about; yes, sir.

Senator HEFLIN. Have you made any effort to buy this project from the Government, or had your company made any effort to do it?

Mr. HAMMITT. No, sir.

Senator HEFLIN. You have not?

Mr. HAMMITT. No, sir.

Senator HEFLIN. Nobody had made any effort to get it, as I understand it, until Mr. Ford made his offer, and now, as I understand you, you testify that the Government should not accept his offer, nor the offer of Mr. Engstrum, nor that of the Alabama Power Co.?

Mr. HAMMITT. Yes, sir.

Senator HEFLIN. And you have not any offer in yourself?

Mr. HAMMITT. That is all quite true, Senator.

Senator HEFLIN. What are you willing to pay for this plant No. 2, if you can get it?

Mr. HAMMITT. If you will not give us anything to boot, we are not prepared to pay anything for it, Senator.

Senator HEFLIN. Then, you would just let it stand there if you had your way about it, rather than to permit them to come into competition with you you would let the dam stand as it is; you would prevent navigation on the river and you would let the whole thing stand still?

Mr. HAMMITT. Yes, Senator; and so would Mr. Ford, unless you would give him something to boot.

Senator HEFLIN. Well, he expects to make money out of it, of course.

Mr. HAMMITT. Not out of nitrates?

Senator HEFLIN. He said he would make 8 per cent on the fertilizers he produced, and Mr. Mayo said this morning, in response to a question asked by me that he was going to manufacture fertilizer on a large scale, and after that

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in response to another question I asked him, as to how cheap they could produce it, he said that they expected to produce it at about half the cost required now in the production of fertilizer. If that is so, it will mean a saving of millions of dollars to the farmers of the country, and would it not be infinitely better for the Government to accept Mr. Ford's offer, so that these farmers will be benefited, and so that we can make that river navigable there for many, many miles, and manufacture fertilizer, in addition to having this plant ready for the manufacture of nitrates in time of war? Would not that be very much better than to permit it to stand still, as you suggest?

Mr. HAMMITT. Senator, if Mr. Ford has a secret process by which he can produce a marketable fertilizer at 50 per cent of the present cost of production, you would not have to give him a subsidy in order to get him into the fertilizer business, because Mr. Ford in that case would be governed by all of his ambitions to serve the farmers——

Senator HEFLIN. I think he thinks he has a secret process.

Mr. HAMMITT (continuing). As well as by his perfectly natural and proper and successfully proven ambition to make money, and he would go into the fertilizer business without any Government aid. But after Mr. Mayo had testified to the possession of this secret process I personally heard Mr. Mayo testify before this committee this morning that it was entirely possible, he might find, this fertilizer plant a liability, and that that was a reason why it was impossible for Mr. Ford to pay more than $5,000,000 for a certain amount of property. Now, we can not put together and make consistent the possession by Mr. Ford of a process by which he can cut cost of manufacture in half, with the fear of his chief engineer, who knows all about that process, that the plant that he gets from the Government for the use of that process may be a liability. It could not possibly prove to be a liability under those circumstances.

Senator HEFLIN. I understood him to say the other day that it might be necessary to expend millions of dollars to make the changes in Plant No. 2 with the process that they have got. That is what he meant when he said it might probably be a liability as it now stands.

Mr. HAMMITT. If you go to that extent in the alteration of Plant No. 2, I hope, in the interest of national preparedness in which, as an American citizen, I am really very much interested, that you will have plans submitted to the nitrate division before they are executed, because you will be in rather serious danger by so altering the plant that it will be no longer capable of manufacturing munitions of war.

Senator HEFLIN. But he does not intend to do anything that the Government would object to or would not approve.

Mr. HAMMITT. Some of the suggestions that have been made for the use of that plant for the manufacture of fertilizer would destroy the character of the plant as a nitrate-producing plant. If that plant were operated for the manufacture of electric furnace steel, with a fertilizer by-product—and it is no secret that there is such an operation possible—it would be necessary, in order to use the plant in that way, to change its character so it would no longer be capable of manufacturing munitions of war. If that plant were to be used for the production of alumina, with a fertilizer by-product, it would require certainly very extensive alterations. The fact is that there have been so many things——

The CHAIRMAN. Now, if it were used for alumina purposes, would that destroy its efficiency as a war proposition to make explosives?

Mr. HAMMITT. Yes, sir.

The CHAIRMAN. What is the by-product going to be—a nitrogen by-product or a potash by-product?

Mr. HAMMITT. In the case of alumina, it would be ammonia.

The CHAIRMAN. That by-product itself could be used as an explosive, could it not?

Mr. HAMMITT. By further processing it could be made into an explosive; yes, sir.

The CHAIRMAN. What would be the quantity of it?

Mr. HAMMITT. Well, my knowledge of that Serpek process is so extremely slight, Senator, I would rather not testify about it.

I would like to complete the answer here to your question. The by-product of the manufacture of steel would be a phosphate in the form of basic slag.

The CHAIRMAN. What about the quantity of that? Could you give us any idea as to that?

Mr. HAMMITT. Well, that would be, using Alabama pig iron, relatively small in quantity.

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The CHAIRMAN. Of course, if we are going to transform this plant—and is the reason I am asking these questions—into a plant for the manufactu something else, with the explosive as a by-product, it becomes at once impo to know what is going to be the volume of that by-product. If it is la might pay to do it. If it is small, it would be foolish to do it.

Mr. HAMMITT. Senator, it seems to me, you want to go to the extent of ing—you should find out what was going to be done with the plant——

The CHAIRMAN. Yes.

Mr. HAMMITT. And after ascertaining what was going to be done wit plant I think you should write it into the contract.

The CHAIRMAN. Certainly. Do not get the idea now—and I think I for all of the committee on this—that there is anybody here who wa leave anything out of this contract that will have a tendency to make it If we make a contract with Mr. Ford or with anybody else, we want t them up even though we might be willing to take the word of the m are binding up.

Mr. HAMMITT. Yes, sir.

The CHAIRMAN. Just as completely as though we did not have any fa his honesty; because whoever makes this contract, either for 50 years hundred years, is going to be dead before it is completed, and somebod is going to carry it out and we do not know who that will be.

Mr. HAMMITT. Yes.

The CHAIRMAN. So that they must be bound by the contract just as pletely as we can do it.

Mr. HAMMITT. That sounds to me like not only good public policy but business judgment, Senator.

The CHAIRMAN. Well, nobody can ask the Government to do anything We can not enter into a contract that nobody understands, of course. was the reason why I was very glad to have your testimony. You have me rather a different viewpoint—I do not know whether it is right or n Mr. Ford's offer to operate this plant to its full capacity. There is a tern in his offer that the ordinary person would not understand. It is nec to use those technical terms; but it may be that there is a way by whic licensee under that kind of a proposition would be able to escape doing we all think his offer is—to run this plant to its full capacity for a hu years.

Senator HEFLIN. Now, Mr. Chairman, since that has been called to our tion it is likely that we would be much more careful in the making contract and would see that there would be no doubt about that.

The CHAIRMAN. Oh, yes. If we make a contract with anybody we make an effort to make one as to which there will be no doubt, of course

Senator HEFLIN. Yes.

The CHAIRMAN. Now, Mr. Hammitt, what is the full name of the company?

Mr. HAMMITT. The American Cyanamid Co.

The CHAIRMAN. Where is it incorporated?

Mr. HAMMITT. In the State of Maine. Its main office is in the ci New York. The plants are located in New Jersey, Florida, and California Niagara Falls, Canada.

The CHAIRMAN. Niagara Falls, Canada, is the only place where yo nitrogen out of the air is it not?

Mr. HAMMITT. Yes, sir.

The CHAIRMAN. Are these other plants operated by subsidiary corpora or by the American Cyanamid Co. direct.

Mr. HAMMITT. The one in California is operated and owned by a corpo of which the American Cyanamid Co. owns 50 per cent of the stock, and a contract agreement votes 51 per cent. In other words, it receives ha profits and controls the company. The others are operated by the Am Cyanamid Co.

The CHAIRMAN. What is the capital stock of the American Cyanamid

Mr. HAMMITT. Slightly over $12,000,000.

The CHAIRMAN. All paid?

Mr. HAMMITT. Yes, sir; I mean that is the amount that is actually i and out.

The CHAIRMAN. Well, is it all issued for equal value of property?

Mr. HAMMITT. All for equal value of property; the greater amount of cash at the amount of——

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The CHAIRMAN. What was the idea of organizing the subsidiary to build this plant down there?

Mr. HAMMITT. There were two reasons for that. One was it was necessary for the Government to exercise the closest kind of supervision over every expenditure of funds, and, for that purpose, it was desirable that the expenditures and the accounts should not be confused with the ordinary business of the American Cyanamid Co. It made it a very much simpler auditing proposition for the Government. That is one reason, Senator.

The CHAIRMAN. Yes; all right.

Mr. HAMMITT. And there was another reason, that it was desired to avoid in an operation of this character, which involved the expenditure of $100,000,000 before the signing of the armistice, endangering the assets of the American Cyanamid Co. In other words, there was a reason for creating that subsidiary corporation for the service of the Government, and there was a reason for the protection of the American Cyanamid Co.

Senator HEFLIN. The Air Nitrates Corporation is a subsidiary of the American Cyanamid Co.?

Mr. HAMMITT. Yes, sir.

The CHAIRMAN. I have not read this contract, and it may be that I am asking you something that is perfectly plain in it. You made a contract with the Government for the building of this plant?

Mr. HAMMITT. Yes, sir.

The CHAIRMAN. And this is the only contract you made with the Government in regard to this plant?

Mr. HAMMITT. That is the only one that the Air Nitrates Corporation made, except that there was a preliminary contract entirely superseded by this one. That is, there was a contract written dated in 1917.

The CHAIRMAN. When was this contract made?

Mr. HAMMITT. It was superseded by this, which is dated June 8, 1918. There was also a contract——

The CHAIRMAN. This plant was mostly built by that time, was it not?

Mr. HAMMITT. Yes, sir.

The CHAIRMAN. Was it not about completed?

Mr. HAMMITT. Well, I said mostly completed. I spoke rather hastily, but the greater part of the construction work actually was done after that contract was signed, but a great deal of it had been done before it was signed.

The CHAIRMAN. Did this corporation complete what was there of the building operations?

Mr. HAMMITT. They did, subject to a very continual day-to-day inspection by the Government.

The CHAIRMAN. You were using Government money entirely?

Mr. HAMMITT. We were; yes.

The CHAIRMAN. And your corporation did not invest any money, did it?

Mr. HAMMITT. Theoretically, we did not. As a matter of fact, practically, there were times, of course, when we had to make expenditures for which the Government had not yet advanced the money.

Senator HEFLIN. What did the Government pay you or your company outside of the actual cost of this construction?

Mr. HAMMITT. The contract provided that we were to have a fee of $1,500,000, of which fee they have paid us something less than $1,200,000. Assuming that the entire fee of $1,500,000 were paid, under the provisions of the war-profits tax law 80 per cent of it, or $1,200,000, is paid back to the United States Treasury in the form of taxes.

The CHAIRMAN. In that respect you are just the same as everybody else that made the same amount of money, are you not; you are just paying your taxes?

Mr. HAMMITT. We are in the same position as everyone else who is in such a class that he is subject to that particular provision of the tax law.

The CHAIRMAN. Yes.

Mr. HAMMITT. Then, in addition to that, something slightly less than five per cent must be paid in taxes to the State of New York, and that leaves $225,000 out of the fee. Now, without compensation other than in this fee, Air Nitrates Corporation was required to furnish to the Government the services of a group of men in whom there resided at that time to a greater extent than any other group of men the knowledge and the experience and the ability to design and construct this kind of a plant, and the compensation of those men was paid out of private funds as a part of the agreement under this contract, and was not charged to the Government.

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Senator HEFLIN. How many men did you have down there.

Mr. HAMMITT. Ten men.

Senator HEFLIN. For how long.

Mr. HAMMITT. Wait a minute. I answered your question a little too early, Senator. Do you mean how many men were engaged in the work on Muscle Shoals?

Senator HEFLIN. No; I mean how many did your corporation furnish, and how long a time were they down there in the construction of this plant.

Mr. HAMMITT. Air Nitrates Corporation furnished to the Government without charge other than as that charge is involved in the fee, the services of ten men, whose entire time over a period of from fifteen to eighteen months was devoted to this work. They were, some of them, at Muscle Shoals during a part of that time, and some of them were elsewhere, but they were engaged upon the work of the designing and construction of this plant, a good many parts of which extended to all corners of the United States, of course.

The CHAIRMAN. These ten men were working with experts of the Government, were they not? You were experimenting somewhat as to just what could be done in the way of machinery and the processes that could be used, and trying to improve it, were you not?

Mr. HAMMITT. No, Senator; the entire process was a proven thing, except for——

The CHAIRMAN. Well, was not the process changed somewhat in the course of the construction of this plant?

Mr. HAMMITT. Not the cyanamid process. I did not quite complete my other answer. I would say the entire process was an entirely proven thing, with the exception of certain features of the last end of the process, as to which we had adequate experience upon the basis of which we could set up something which we were perfectly sure would work. In other words, it was never an experimental thing from the start to the finish. We knew exactly what we wanted to do, and it was simply the details of the work in designing, such as you would have in the building of any large manufacturing plant.

The CHAIRMAN. Was there not, in the course of the construction of the plant there, investigation continually going on between your men and the Government's scientific men with regard to the process, with a view to improving it, and did you not improve it somewhat during that time?

Mr. HAMMITT. I am not aware of any such developments, Senator.

The CHAIRMAN. Is there anything in this contract that provides—or if it is not in this contract is it in the other contract that you had with the Government—your scientists and the Government scientists, in working together and developing new improvements in the process, that if they should be developed, even by the Government's men that the Government had there, you should be entitled to get it patented and get the benefit of it, so that you would have a monopoly of it afterwards in any other plant?

Mr. HAMMITT. No. There is a provision by which any development of that character by any of the employees of Air Nitrates Corporation, who, of course, were the only employees on that job that were paid out of the Government Treasury, that for any such developments by them there should be granted a license to the United States Government.

Senator HEFLIN. What business were those 10 men engaged in before they went down there to do this work?

Mr. HAMMITT. The cyanamid business.

Senator HEFLIN. What salaries were they getting per year?

Mr. HAMMITT. Well, I could not, offhand, give you a complete list of the salaries of the 10 men, Senator.

Senator HEFLIN. Well, the average?

Mr. HAMMITT. They were compensated in a total in all the different forms of compensation they received out of private funds to an amount slightly in excess of the balance of our fee after we paid taxes. Those 10 men have received compensation in greater amount for a similar period from the same private funds since the war.

Senator HEFLIN. Well, about what salary were they getting on the average, would you say, at the time they went down there?

Mr. HAMMITT. I would say the average compensation for such a period as this work required was $25,000 a year.

Senator HEFLIN. And under this fee paid by the Government they received over $75,000?

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Mr. HAMMITT. No, sir; they received no compensation of any character from the Government.

Senator HEFLIN. I mean, you furnished 10 men and they superintended this work and the Government has already paid you $1,200,000 fee for that service rendered?

Mr. HAMMITT. Well, as I stated, our expenditures under that contract—necessary expenditures—exceeded the total amount that we have received, or will receive, from the Government; so that when the books are entirely closed on the operation we will have netted an actual cash loss in connection with the services that we rendered to the Government.

The CHAIRMAN. What you got out of the Government you more than used in paying salaries, then?

Mr. HAMMITT. Yes; and in addition to that there were a good many expenditures necessary to be made on that job that the Government did not reimburse and undoubtedly many which they never will reimburse.

The CHAIRMAN. This plant was operated for a while, was it not?

Mr. HAMMITT. It was.

The CHAIRMAN. How much did you get in the way of royalties? Have you counted that in?

Mr. HAMMITT. Yes. Our royalties and operating fee for the period of operation amounted in total to about $15,000.

The CHAIRMAN. How long did you operate it?

Mr. HAMMITT. It was an intermittent operation that extended over a period of several months.

The CHAIRMAN. Well, the Government paid all of the expenses of that operation, did it not?

Mr. HAMMITT. Yes.

The CHAIRMAN. Was not that a clear profit that you made then; that $15,000?

Mr. HAMMITT. I have included that in.

The CHAIRMAN. In your other items?

Mr. HAMMITT. In my statement, the net result of which is that all the money we have received is not equivalent to the money that we have paid out, after the books are entirely closed on the operation.

The CHAIRMAN. But the greatest bulk of that is because you are liable for taxes?

Mr. HAMMITT. Yes, sir.

The CHAIRMAN. And the fact, as you say, that you paid 80 per cent shows that your income was so great that you were paying a tax under the highest brackets of the excess profit tax?

Mr. HAMMITT. No; it was the war profit tax.

The CHAIRMAN. Well, the war profit tax.

Mr. HAMMITT. And the reason that we paid 80 per cent was because more than 50 per cent of the business of the Air Nitrates Corporation was Government business during the war, you see.

The CHAIRMAN. Yes.

Mr. HAMMITT. That is one of the effects of the creation of the separate subsidiary corporation.

The CHAIRMAN. Or you might say it is one of the effects of the taxation, that the Government had to get some money to conduct the war or the profiteers could not have made anything, and they had to ask you and somebody else to do it.

Mr. HAMMITT. And we have not the slightest complaint, of course, nor do we think there is anything unjust in the fact that we came out of this operation without a profit. The Government, as a matter of actual fact, did not get any nitrates from this plant that were actually used in the war. The purpose for which the plant was designed was to supply something in a campaign of the year 1919. We never had the campaign and we never used the material.

The CHAIRMAN. Of course if it had been known that we were not going to have the campaign we would have saved that money.

Mr. HAMMITT. Precisely.

The CHAIRMAN. That is a part of the expenses of the war.

Senator HEFLIN. Do I understand you to say, aside from the tax question, that you expended money down there in connection with the construction of plant No. 2——

Mr. HAMMITT. Which was not reimbursed.

Senator HEFLIN (continuing). Which was not reimbursed by the Government?

Mr. HAMMITT. Yes, sir.

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Senator HEFLIN. How much was that?

Mr. HAMMITT. I can not tell you how much, but as a matter of fact the matter has not been entirely settled yet.

The CHAIRMAN. Are you not entitled under this contract to reimbursement for anything of that kind?

Mr. HAMMITT. Questions arose like this, Senator: Some of these items that have not yet been reimbursed include advances that were made to our employees in order that they might be able to purchase meals in the mess halls when they first arrived on the job, which advances theoretically were to be collected out of the wages of those employees. Some of the men left the job before they had earned wages enough to pay these advances. That is one class of item that exists in that list. Now, undoubtedly the Government can reimburse some of these expenditures. Undoubtedly there are some of these expenditures that the Government can not reimburse, and that sort of thing is incident to every such job.

The CHAIRMAN. Yes.

Mr. HAMMITT. And I think perhaps we were exceedingly fortunate in being able to handle this job with a minimum amount of that sort of thing.

Senator HEFLIN. Have you made a demand on the Government for the reimbursement of these funds?

Mr. HAMMITT. We have submitted all of these accounts, and they were disapproved by the director of construction, and we have the question pending. It has not been pressed by us with any great degree of vigor with the War Department for the collection of all that we can collect, or what has not yet been paid. We have not pressed it simply because it is a considerable amount of detail and it just has not gotten to the point yet where we have pressed it. I have no doubt that the remainder of the fee will be paid, and I have no doubt that some of these other expenditures will be reimbursed. I have no doubt that all of them will not be reimbursed.

Senator NORBECK. I want to ask you one more question. Referring to this tax you speak of, is that the tax of the subsidiary corporation that constructed the plant?

Mr. HAMMITT. Yes, sir; and the fees are paid to the subsidiary corporation.

Senator NORBECK. Yes.

The CHAIRMAN. Of course, the contract was made with the subsidiary corporation. As far as the Government is concerned, it has not any contract with the parent corporation.

Mr. HAMMITT. That is not quite true, Senator, because this license agreement——

The CHAIRMAN. Oh, yes.

Mr. HAMMITT. Was made.

The CHAIRMAN. Let me make this statement here: I asked you a question a little while ago that rather insinuated that you had some contract with the Government by which the Government employees, if they discovered anything new, it would be utilized by the company, and that the company would have a right to patent it. I knew that such contracts had been made. I knew something about them and had made some investigation of them, but I am informed by Major Burns that I was mistaken as to such a contract being made with your company. It was with another company entirely, a company with which you have nothing to do; so, to the extent that that question implies that I had knowledge that you had such a contract—and I would not consider it very honorable—I offer this explanation as an apology. If I had known the facts, I would not have asked the question.

Senator HEFLIN. Mr. Chairman, in order to get that matter covering the fee clear, I want to ask the witness a question.

Do you mean to say that the Government has paid you in money a fee of $1,200,000?

Mr. HAMMITT. Slightly less than that.

The CHAIRMAN. Well, around that?

Mr. HAMMITT. Yes.

Senator HEFLIN. Over a million dollars?

Mr. HAMMITT. Yes, sir; pretty nearly $1,200,000.

Senator HEFLIN. Then you said that you have been out more than that amount?

Mr. HAMMITT. Yes, sir.

Senator HEFLIN. Can you state in what way you lost this money?

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Mr. HAMMITT. Well, the greater part of it——

Senator HEFLIN (interposing). What you did that caused you a loss in excess of that which the Government paid you?

Mr. HAMMITT. The largest two items, Senator, constituting the greatest part of it, are, first, taxes——

The CHAIRMAN. That is 80 per cent.

Mr. HAMMITT. Yes; as a matter of fact it is nearly 85 per cent when you include the State taxes; and, second, the compensation of these men whose services we were required to furnish, and paid for, but under the contract were not to be reimbursed for by the Government.

Senator HEFLIN. Do you mean you paid the taxes out of this money that was paid to you by the Government?

Mr. HAMMITT. Yes, sir.

Senator HEFLIN. And you were not to charge anything for the time and skill of the men you furnished?

Mr. HAMMITT. For those 10 men, no. That is covered very specifically in the contract. It is referred to in article 4 of the contract, on page 26. That is the license agreement. It is also referred to in the contract, in article 10, page 11, in the following language:

"The agent shall make no charge to the United States for the following things:

"1. For procuring from the American Cyanamid Co. a license to it as agent of the United States to use the said company's patents and processes.

"2. For procuring from the American Cyanamid Co. the disposal, for purposes of the Air Nitrates Corporation, of the said company's experiences, records, and plans appertaining to the production of the said chemicals hereinabove referred to.

"3. For procuring from the American Cyanamid Co. the disposal for the purposes of the Air Nitrates Corporation of the following members of the said company's executive and technical force, namely, the president, vice president and general manager, sales and traffic manager, engineering assistant to general manager, superintendent of manufacture, chief technologist, chief engineer, assistant engineer, and in addition thereto, in connection with the operation of the said plants, two principal works managers, as such offices may from time to time be filled.

"4. For procuring from the American Cyanamid Co. the disposal, for the purposes of the Air Nitrates Corporation, of all of the said company's plants for the purpose of training superintendents, foremen, and chief operatives."

Now, the only item in that list of four services to be furnished without charge, to which I have made reference, and the only item that involved a substantial and discoverable expenditure of money, is the delivery of the services of these 10 men, and those services cost money, and that money constitutes a substantial item. The Air Nitrates Corporation paid it and had to take it out of what was left of its fee, and when they did, there was not anything left of the fee.

The CHAIRMAN. Well, did they devote all of their time to this plant?

Mr. HAMMITT. Yes, sir; they did.

The CHAIRMAN. I wonder, if we analyzed it, would it be found that these same people owned the principal stock of the company?

Mr. HAMMITT. It would not; no, sir.

The CHAIRMAN. Would it be found that they were getting a different salary during this time than they got before or have been getting since from their company?

Mr. HAMMITT. No, sir. Their compensation was on no more favorable basis during that period of time than it was prior to that time. There were a few instances in my present knowledge where their compensation has been on a more favorable basis since.

The CHAIRMAN. What salary does the president of the company get now?

Mr. HAMMITT. The president's compensation is in the form of a salary plus an arrangement in regard to a division of earnings, and the salary itself is $25,000 a year.

The CHAIRMAN. And in addition to that he gets a per cent of the earnings of the company?

Mr. HAMMITT. Yes, sir.

The CHAIRMAN. How much?

Mr. HAMMITT. After a certain amount of deductions have been made. I wonder if you want me to put all that in.

The CHAIRMAN. Well, I do not know that it is necessary.

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Senator NORBECK. I do not think it has any bearing on this. The Gove did not pay these salaries. They were paid by the company.

The CHAIRMAN. I do not think so. I asked the question because yo saying that they had not made any money.

Mr. HAMMITT. Yes, sir.

The CHAIRMAN. Of course, if they were the principal stockholders of t pany it would not make any difference whether they were getting it in the of a salary or in any other way. If they were getting a big salary the paid it, anyway.

Mr. HAMMITT. Yes.

Senator HEFLIN. It would have some bearing on the cost of fertiliz Chairman.

The CHAIRMAN. Yes.

Senator HEFLIN. The paying of these big salaries to their officers.

Senator NORBECK. It has been my experience that the high-priced man i the cheapest man.

The CHAIRMAN. I think you can go to extremes either way. I would be classed as a cheap man myself, but I do not get a large salary.

Mr. HAMMITT. There are, of course, some of these men, Senator—and to be sure that I have not created a wrong impression on the record- are some of these men who are stockholders in the American Cyanam Of course, all of the stock in the Air Nitrates Corporation was owned American Cyanamid Co., and there is just one stockholder.

The CHAIRMAN. Yes.

Mr. HAMMITT. But there is no one of these men, nor the whole group o together, that owns, I should say, more than 5 or 6 per cent of the st the American Cyanamid Co.

The CHAIRMAN. The stock is pretty widely distributed?

Mr. HAMMITT. Yes.

The CHAIRMAN. There is a good deal of it owned abroad, is there not

Mr. HAMMITT. No; there is probably between 10 and 15 per cent of the owned abroad.

The CHAIRMAN. When I say "abroad"——

Mr. HAMMITT. I mean in all foreign countries.

The CHAIRMAN. That includes Canada?

Mr. HAMMITT. That includes Canada; yes, sir.

The CHAIRMAN. Of course, it is possible that by this arrangement officers get a salary and then a per cent of the income, and it never wo possible for the company to pay any dividends to its stockholders fo reason.

Mr. HAMMITT. No; because before they ever share in the earnings t earnings must be sufficient to pay these dividends.

The CHAIRMAN. As I understand the contract, it provided that, on part, the Air Nitrates Corporation should, with the Government's money struct this plant, that you should build No. 2, that the Government furni money and you furnish the plans and specifications. Did you do that f the buildings?

Mr. HAMMITT. Yes.

The CHAIRMAN. And you managed the construction of it?

Mr. HAMMITT. And assembled the organization and supervised the struction.

The CHAIRMAN. Yes; and supervised the construction.

Mr. HAMMITT. Yes.

The CHAIRMAN. For that, under the contract, you were to be given a $1,500,000, were you not?

Mr. HAMMITT. Yes, sir.

The CHAIRMAN. Then you were given a royalty on everything that was there in that plant?

Mr. HAMMITT. Yes, sir.

The CHAIRMAN. And if the plant had been operated, as was contempla the time both by your company and by the Government, you would ha ceived very substantial sums in the way of royalties, would you not?

Mr. HAMMITT. Yes, sir.

The CHAIRMAN. That did not pan out, because the war stopped.

Mr. HAMMITT. Yes, sir.

The CHAIRMAN. Now, did you get any other fee besides the royalties?

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Mr. HAMMITT. Yes. We would have received during that operation—that is, when the Air Nitrates Corporation was operating the plant—we would have also received an operating fee.

The CHAIRMAN. An operating fee?

Mr. HAMMITT. Yes, sir.

The CHAIRMAN. You did not make the money you expected to make on it because the war ended, and that was the only reason you did not make it, is that it?

Mr. HAMMITT. That is quite true, Senator.

The CHAIRMAN. In addition to that, you——

Mr. HAMMITT. That is the only reason we came out with a loss on the operation.

The CHAIRMAN. Yes. And in addition to that you had put into the contract that if the Government sold this property it was to give you the opportunity of being the first one to purchase?

Mr. HAMMITT. Yes, sir.

The CHAIRMAN. Now, under ordinary circumstances, if it had been operated, you would have been fully compensated for all of your efforts, even without section 19, which provides for the purchase clause, and you did not make the money out of it that you expected to, because, simply, it never was operated, and everybody was glad, of course, because the war was over, and you did not have to operate it. How much, under this contract, are you to get if this thing is operated to its capacity, in the way of royalties?

Mr. HAMMITT. We would have received royalties during the war on one basis and after the war on a different basis.

The CHAIRMAN. Yes. Give it to us on both bases.

Mr. HAMMITT. The war royalties were 6 mills per pound of nitrogen fixed in the form of lime nitrogen. That is a little complicated, but I will explain that in just a minute. On the basis of postwar royalties it was 1½ cents per pound of nitrogen fixed in the form of lime nitrogen. The first form in which nitrogen taken from the air is fixed in that process produces a material which was referred to in this contract as lime nitrogen, and it is generally described as either line nitrogen or crude cyanamid, and it was from a measure taken at that point of the amount of nitrogen fixed that these royalties were determined. Then the Government would direct what further processing there would be after that and ultimately that nitrogen would come out in the form of ammonium nitrate, or, if the Government made another decision, in the form of some other kind of nitrogen.

The CHAIRMAN. Now, tell us if the plant had been operated a year to its capacity during the war——

Mr. HAMMITT. Yes, sir.

The CHAIRMAN (continuing). How much you would have received in the way of royalties.

Mr. HAMMITT. We would have received approximately $480,000 in royalties annually.

Senator HEFLIN. How much operating fee?

The CHAIRMAN. I am getting at that, Senator.

Senator HEFLIN. All right.

The CHAIRMAN. $480,000. What would have been the operating fee for that year?

Mr. HAMMITT. The operating fee would have been approximately the same amount.

The CHAIRMAN. $480,000. Now, is there any other kind of fee that you would have received?

Mr. HAMMITT. Assuming that you ar not now considering the construction fee heretofore mentioned, there would be no other.

The CHAIRMAN. What would you have been compelled to expend in the way of operation there? What would you have supplied?

Mr. HAMMITT. We would have supplied simply these——

The CHAIRMAN. These men that you have enumerated before?

Mr. HAMMITT. So far as the things we would have supplied would have required out-of-pocket expense during that year, we would have supplied only the service of these men.

The CHAIRMAN. How many men?

Mr. HAMMITT. Ten.

The CHAIRMAN. Ten men?

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Mr. HAMMITT. Yes, sir.

The CHAIRMAN. What would have been their combined salaries?

Mr. HAMMITT. Well, my recollection is, Senator, that their combined pensation in a normal year would be about $160,000.

The CHAIRMAN. $160,000; and then, as a matter of fact, those men get average of $16,000 a year apiece; and one of them is just a workman, is he

Mr. HAMMITT. Oh, no.

The CHAIRMAN. An expert workman, of course.

Mr. HAMMITT. No.

The CHAIRMAN. But there are two of them, I think——

Mr. HAMMITT. No; there is not a single man on that list who is not a h trained man.

The CHAIRMAN. What is the lowest salary of any one of them?

Mr. HAMMITT. I can not tell you from recollection, Senator.

The CHAIRMAN. Taking them at their maximum, and say $160,000, it have left you, then——

Mr. HAMMITT. That is not their maximum. That is my recollection of the compensation of those men would have been prior to the war.

The CHAIRMAN. That would have left you a profit in a year, withou financial investment whatever, of $800,000. Now, let us figure the same thi a peace basis. What would you have made in a year if they operated it the war was not going on? It would have been somewhat less than that?

Mr. HAMMITT. No, sir; it would have been more than that.

The CHAIRMAN. Would it?

Mr. HAMMITT. The royalty would have been adjusted to something nearly an ordinary basis. This royalty during the war figures out on a ridic basis, Senator, so far as royalties are ordinarily computed.

The CHAIRMAN. It looks to me like a comfortable sum there. I do not k maybe you would get poor at it; but $960,000 a year, without any investm money, is a pretty good thing.

Mr. HAMMITT. Of course, if you license a manufacturing company to o under a process in which you have invested a considerable sum of money, you have not got an out-of-pocket expense in connection with their operatio have got something for which you are entitled to ask compensation.

The CHAIRMAN. Yes, certainly; I agree with that.

Mr. HAMMITT. And that compensation, ordinarily, in my experience royalty matters, runs somewhere around 10 per cent of your selling price, it is a controlling patent.

The CHAIRMAN. This is really coming to you because of the use of you ents, is it not?

Mr. HAMMITT. Yes.

The CHAIRMAN. That is the foundation for that.

Mr. HAMMITT. Yes; that is the foundation of the royalty fee.

The CHAIRMAN. Yes. Of course, you ought to recognize that the Gover gave you this monopoly in the way of a patent for about $50 or $60 to begin

Mr. HAMMITT. No; I do not realize anything of the sort, Senator. I d think you really mean that; because what the Government gave us for ou and the expense of obtaining patents, which, of course will run into not a substantial sum, but some of them very much more than $50 or $60——

The CHAIRMAN. I mean for each patent. I do not know how many you

Mr. HAMMITT. Was the right to have protected under the general law developments in the art for which we have expended actually millio dollars.

The CHAIRMAN. Maybe you did, but usually the fellow that really do work on a patent does not get anything. The fellow that gets it patente the money, but the man who actually does the invening dies in the poor That is what usually happens.

Mr. HAMMITT. That is unfortunately very frequently true.

The CHAIRMAN. But the Government does give you a monopoly, and not complaining about it. You have a right to get it; but here is a case it gave you a monopoly on certain patents and when it wanted to use itself you charged the Government, which you had a right to do, with a to making a profit during the war in addition to your other fees; so it w a charitable proposition that you were doing for the Government, even th as it turned out, you were not making any money.

Mr. HAMMITT. In my testimony I do not want you to think that I eve tended that this was entirely a charitable operation. I have not mad

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such contention. What the Government would have saved on that operation in one year, if it had taken place, Senator, just taking the difference between the Government fixed price of ammonium nitrate and the Government fixed cost of producing nitrate at Muscle Shoals, based upon their actual test runs, with green men, would amount to a saving of $15,000,000 a year.

The CHAIRMAN. No; I do not see it.

Mr. HAMMITT. The fixed price of ammonium nitrate was $300 a ton. That was the Governmenet fixed price of ammonium nitrate. The ammonium nitrate actually produced at Muscle Shoals cost $169 a ton.

The CHAIRMAN. Well, you do not mean to say now, do you, that because the fixed price was $300 a ton that your company would be entitled to all the credit, if it got it for less than that?

Mr. HAMMITT. I mean to say that the thing we gave to the Government was not on the basis of a charitable operation, as you said.

The CHAIRMAN. I mean you sold it to the Government and you got paid for it.

Mr. HAMMITT. Now, we are discuss ng the question of whether or not the compensat on was reasonable, are we not, Senator, and I am saying that if we were dealing with anything except a war service, we certainly would have been better traders than to have accepted that amount of compensation from a purchaser who was getting that amount of benefit.

The CHAIRMAN. Of course, that is a question of policy. There could be a great deal sa d on the side that the Government ought to be able to use for its own use at any time anyth ng that it has given as a monopoly to somebody else by way of a patent; but there is not any question of law, and of course, I am not contending that there is. You are entitled to whatever reasonable arrangement you can make, and I am not saying that you made an unconscionable one, but certainly it looks to me as if in this contract you were well provided for. Because you did not make a lot of money out of it was not your fault, nor the fault of the contract, either.

Mr. HAMMITT. The reason we did not make any money was because the armistice was signed.

The CHAIRMAN. And you had to pay your taxes. Of course, we all had to do that. I did not make any money that same year myself. On my enormous salary of $7,500, I ran a little behind in that year. If we are going to have war, we must pay for it. If we want to dance we have to pay the fiddler. Somebody has to do it. If it takes a 100 per cent of a man's income, he has to stand for it, put it up and look happy.

Mr. HAMMITT. I agree with all of those statements, Senator.

The CHAIRMAN. Now, I w sh you would give us the figures for the record on what your income would be in one year under this contract in the shape of royalties, if the plant were operated for one year to its capacity.

Mr. HAMMITT. The gross income would be about $480,000. I have given you that before, Senator. Oh, you mean in times of peace.

The CHAIRMAN. Yes, that is what I want. You have given it to us in war times.

Mr. HAMMITT. Yes.

The CHAIRMAN. Your royalties were $480,000, you said.

Mr. HAMMITT. Yes; you are right, $480,000.

The CHAIRMAN. That is in time of war?

Mr. HAMMITT. Yes.

The CHAIRMAN. Now, in time of peace it would be more than that.

Mr. HAMMITT. Yes.

The CHAIRMAN. How much would it be?

Mr. HAMMITT. $1,320,000.

The CHAIRMAN. Now, if we were to accept the bid of Mr. Engstrum, for instance, or Mr. Ford, or if we were to put the bill through that I have introduced, and the Government operated this through a Government corporation, we would have to pay you under this contract in the shape of royalties, $1,320,000 per year, would we not?

Mr. HAMMITT. Subject to arbitration; that is, Senator, there is a provis on in this contract that if either party considers that royalty unreasonable, he can have it arb trated.

The CHAIRMAN. Does that apply to war and peace times, both?

Mr. HAMMITT. No; that appl es only to the peace time royalty, but it applies to this $1,320,000.

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The CHAIRMAN. Now, let me get clear another item that seems to be mixed up here. On this peace-time operation you are not required to furnish the men?

Mr. HAMMITT. No; not unless——

The CHAIRMAN. Well, they would have to make some other arrangement for it?

Mr. HAMMITT. Yes.

The CHAIRMAN. They would have to pay for it, in other words, but what I am getting at is this: This royalty of $1,320,000 is net to you, no matter who operates it, just so it is in times of peace.

Mr. HAMMITT. There is no out-of-pocket expense against it, of course. Ordinarily, really, any royalty is net.

The CHAIRMAN. No; you have expressed it fully when you say that. That is what I meant by "net." I do not know whether I used the right term or not.

Mr. HAMMITT. Although I stated subject to arbitration. I would like also to state that, in my personal judgment no arbitration would reduce it. The reason I speak that way is that I do not believe it is an unreasonable royalty.

The CHAIRMAN. Of course, it would stand in the way of any operaton that had to be conducted. It seems to me, though, that your corporation is very well protected by this contract under any possible contingency. Now, your company's grasp or control of the situation in the fertilizer proposition would seem to be almost a monopoly.

Mr. HAMMITT. We had an absolute monopoly, of course, of the cyanamid process until the war came along, and we could have provided the Government with this plant, operated it for the Government during the war, and still it would not be necessary for that monopoly, necessarily, to be interfered with or broken after the war. In other words, no war service required that we should part with any part of that monopoly, but to whatever extent we have parted with that monopoly that is just something it has cost us to go into this Muscle Shoals operation.

The CHAIRMAN. What I am thinking of particularly is the fertilizer proposition, the use of this plant in times of peace. To what extent does your company control the fertilizer markets of the country now?

Mr. HAMMITT. We are very small factors in the fertilizer industry, Senator.

The CHAIRMAN. Could you give us an idea of about what per cent of it comes through your various corporations?

Mr. HAMMITT. Perhaps not more than 1 per cent.

The CHAIRMAN. Well, it looks to me, then, if you are so small a factor in the fertilizer proposition, you are unduly alarmed, and that as a financial proposition, you could better afford to have the Government either operate this plant or have somebody else operate it and get this royalty out of it than you could to have your profits on the fertilizer, unless you get an enormous profit on your fertilizer interests. You stand to make, if the Government operates this plant or if anybody else operates it, and this contract is held to be good, $1,320,000 without any further investment or without any risk whatever, and whatever you make outside of that, of course, is extra for your corporation. Why is it you are so anxious that this should not be operated and you should be deprived of this $1,250,000, in round figures?

Mr. HAMMITT. Well, I hesitate to talk for a public record on one phase of the problem, Senator, which is based on the general fact that the collection of royalties, even when they are firmly owed sometimes requires a considerable amount of very costly and somewhat hazardous litigation.

The CHAIRMAN. But you do not anticipate that in this case, do you?

Mr. HAMMITT. I hope that we would not have any such experience, and yet when we enter, as we did, into this kind of a contract with the Government and then have to argue a case afterwards as to whether that provision of the contract with the Government, and then have to argue a case afterwards as to whether that provision of the contract with the Government itself should be adhered to, it gives us a little bit of doubt as to whether dependence upon our rights to collect may mean anything whatever except dependence on our ability to enforce our rights in litigation.

The CHAIRMAN. Suppose Mr. Ford gets this contract—let us take his case now—and he buys this plant under his arrangement, and he starts manufacturing there to its capacity. Have you any doubt that you have a legal claim against him that would enable you to collect every year the sum of $1,300,000?

Mr. HAMMITT. Well, I think ultimately we would collect that $1,300,000.

The CHAIRMAN. In other words, if you are satisfied with this contract, and you think it is all right in every respect, why are you afraid?

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Mr. HAMMITT. I am not in the least bit afraid, Senator, of the ultimate result, but I think one of the things that are generally understood regarding Mr. Ford, for example—and this, no doubt, has a very great importance in the general discussion—is that one of the things he definitely does not believe in is patents and the general understanding is that if you collect royalties from Mr. Ford, as some people do, you collect them only after you have thoroughly established, beyond any shadow of doubt, your right to that royalty in the courts.

Now, I do not believe that Mr. Ford would operate this plant to capacity continuously. I believe that there would be one or another thing that would happen down there at that Muscle Shoals plant, that would begin with the placing upon the market at less than cost of production a considerable quantity of a fertilizer material which would cost Mr. Ford some money to do that, and it would cost us money to meet that situation. It is, as I say, a question of business judgment as to whether these royalty provisions offer us adequate protection, and we do not believe, as a matter of business judgment, that they do, and so we ask for that protection which is provided for in the contract that we wrote with the Government.

The CHAIRMAN. Now, that means that you want an opportunity to buy it; you want the first opportunity?

Mr. HAMMITT. We do; yes, sir.

The CHAIRMAN. And yet you say the plant is of no account unless there is something thrown in with it?

Mr. HAMMITT. But we want the something thrown in also, Senator.

The CHAIRMAN. I know you do. It must follow now that you think there is an awful lot in it, or it must follow that you are making enormous profits in your fertilizer business when you say you would make less than 1 per cent on it, because you are going to get, if your contract is good, which you think it is, $1,320,000 a year, if somebody else gets it; so you must think that there is more than $1,320,000 a year in it for you if they do not get it.

Mr. HAMMITT. I do not think, Senator, that there is going to be a continuous capacity operation of that nitrate plant under Mr. Ford's offer or under any other proposal, and I do not think there is any good business judgment back of depending upon the continual collection of $1,320,000 out of a losing manufacturing operation. It would seem to me to be very poor business judgment to expect that.

The CHAIRMAN. If he does not operate it that is just what you want.

Mr. HAMMITT. I think there will be a stab made at that operation, and I think there will probably be a considerable amount of production, and there will probably be a considerable amount of litigation that will arise out of——

The CHAIRMAN. I would like to see him operate it if I were you, because I would get that $1,320,000.

Mr. HAMMITT. I have also indicated, Senator, that I have considered the Ford contract as outlined by him as an exceedingly valuable contract.

The CHAIRMAN. I know you have.

Senator HEFLIN. In other words, if the Government decides that it will accept Mr. Ford's offer, you say, "Now, if you are going to do that, we are ready to take it." Is that your contention under your contract?

Mr. HAMMITT. Yes, sir; that is our interpretation of the provision of the contract.

Senator HEFLIN. Yet you stated this morning to the Chairman, as I understand you, that plant No. 2 was worth at least $15,000,000 now as it stands.

Mr. HAMMITT. No; I gave a hasty and very rough estimate of the scrap value, which I think came to about $15,000,000 for all of that property down there covered in the Ford offer, other than the dams.

Senator HEFLIN. That includes land and houses on the lands?

Mr. HAMMITT. It includes plant No. 1. It includes the Government interest in the Gorgas steam-power plant, and includes the transmission line property.

The CHAIRMAN. And plant No. 2?

Mr. HAMMITT. And plant No. 2.

The CHAIRMAN. All the land around there with the houses and buildings?

Mr. HAMMITT. Yes, sir.

The CHAIRMAN. Whatever they may be, but it does not include, Senator Heflin, the dams or any of the houses connected with the dams. There are a good many buildings up there, you know.

Senator HEFLIN. Yes.

The CHAIRMAN. Yes. He said that the scrap value of it would be $15,000,000. Personally, without having an expert to look it over, and seeing all of those

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buildings and everything that there is there, it seems to me that you low. I think it is more than that.

Mr. HAMMITT. Well, I thought it over and discussed it somewhat si testimony this morning, and I think I would change that testimony so and say instead of that that was a fair estimate, it is a modest estin would not want to change my statement any more than that.

Senator HEFLIN. Now, if Congress decides to accept Mr. Ford's offer, a you come in and under your contract are permitted to take it off th of the Government at that amount, what would you do with it?

Mr. HAMMITT. Why, Senator, I think maybe we would see if we co find some way of getting introduced to Mr. Ford's secret process.

Senator HEFLIN. You would get hold of his secret process?

Mr. HAMMITT. I think we might want to be introduced to his secret if we were placed in that position; but the thing that impresses me, Sen that if it were held out as compensation for doing a difficult thing, t were prepared to give that water power to them, and if the Gove financed it on the kind of terms that Mr. Ford has proposed, it wou tremendously valuable thing.

Senator HEFLIN. Oh, yes; if you were to take it off the hands of t ernment, you would want it at the amount that we would agree to Ford have it, without the stipulation that you were going to manu fertilizers, as he agrees to do.

Mr. HAMMITT. As I have stated, I do not know how you can make a very workable out of this particular stipulation involved in this Ford of even if there were a stipulation that was actually workable and which i a guaranty to engage in a fertilizer operation, it still seems to me that could very well afford to turn down a proposition that involved so much as involved in that Ford offer.

Senator HEFLIN. But rather than permit Mr. Ford to get it and manu fertilizer in competition with you, would you not give the amount that gests he is willing to give and let it stand idle?

Mr. HAMMITT. Well, I have never been faced with any such alternati but we certainly could not afford to pay that amount and keep the plant

Senator HEFLIN. Well, you suggested you would not agree to make fe unless you could get hold of his secret process.

Mr. HAMMITT. Oh, no; I meant merely to indicate the fact that yo touched upon what would be the most difficult part of our problem, and Ford has a secret process that can make fertilizer at half the present co would be a very excellent solution of the problem. I think it would be while to wrestle with that problem, if you could have as your compensat doing so that water power delivered on the kind of terms contained in Mr offer; but that, I think, is a pretty heavy price to pay to induce any operate a plant which is not a feasible commercial operation.

The CHAIRMAN. If the Senator is through I want to ask you to go bac to the beginning of your testimony, where you made some statement abou as to what you had to pay in Canada for your power.

Mr. HAMMITT. Yes, sir.

The CHAIRMAN. Assuming that Dam No. 2 is finished and Dam No. ished, by the utilization of steam power to convert secondary into p power, and assuming that you can use all the power you produce, what, judgment, would be the cost per kilowatt hour down there at Muscle Sho

Mr. HAMMITT. Well, I am afraid I am not sufficiently equipped with liminary study of that question, Senator, to give you a very reliable es but I think, in general, the estimates of cost of power submitted to the committees of Congress by Col. Hugh Cooper a year ago are reasonably estimates for the Muscle Shoals development.

The CHAIRMAN. Do you remember what they were?

Mr. HAMMITT. Yes; he estimated that the primary power based on the ment only of Dam No. 2——

The CHAIRMAN. All right.

Mr. HAMMITT. Would be worth 4.4 mills per kilowatt hour, assum payment of 5 per cent interest on the Government's investment.

The CHAIRMAN. And what assumption about the secondary power?

Mr. HAMMITT. And the assumption about secondary powers—and this the sale of a considerable amount of secondary power, the sale, as a m fact, of 450,000 horsepower years of secondary power at an average of 1 per kilowatt hour.

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The CHAIRMAN. The sale of how much at 1.2 mills?

Mr. HAMMITT. Four hundred and fifty thousand horsepower years, on a 50 per cent load factor, which means that he would get only kilowatt hours out of it for half time.

The CHAIRMAN. What I am trying to get at is this: I want to see if there can be a condition brought about down there at Muscle Shoals that would give us power as cheap as you get it at Niagara Falls on the Canadian side. Have you given enough attention to the probability of the development of storage reservoirs, etc., so that all the power produced could be utilized and as much as possible turned into primary power, to give an answer to that question?

Mr. HAMMITT. I think I could say that it is probably impossible to deliver at Muscle Shoals primary power at as low a price as we pay for power. I think that if that development is made in a normal way there will be secondary power that will be substantially cheaper than the power that we have at Niagara Falls; I mean cheaper per kilowatt hour.

The CHAIRMAN. Yes.

Mr. HAMMITT. I should think that the secondary power down at Muscle Shoals ought to be exceedingly cheap.

The CHAIRMAN. Well, some of it would be, but it would depend on what portion of the year you were going to use it, I suppose, and its market value depends on that to a great extent.

Mr. HAMMITT. I do not think in the operation of a nitrate plant it would make any great difference what portion of the year you had the power, practically, because the only practicable way of operating that nitrate plant with secondary power would be to shut it down during the period when you did not have power.

The CHAIRMAN. Now, taking that idea, suppose we went on the theory that we would shut it down three months of the year, during the driest part of the year, and then operate it on the power that was not in existence during the driest part of the year; in other words, with secondary power; you could figure that cost at almost any figure you wanted to, because there would not be any way to say just what that power was worth, would there? I do not mean what it is worth, but what it would cost to develop it.

Mr. HAMMITT. No. Well, for one thing, it would cost the generating equipment, which you would not require if you did not have that amount of power.

The CHAIRMAN. But that would be about the only extra amount of cost that you would be put to, would it not?

Mr. HAMMITT. Yes, sir.

The CHAIRMAN. On that basis could not that plant be operated and make nitrates as cheaply as you make them with your cheap power?

Mr. HAMMITT. Certainly not, unless you operated that Muscle Shoals plant to its capacity, and even then I would say that you could not if you had to shut——

The CHAIRMAN. Well, if you had it for nine months in the year and then shut it down for three months.

Mr. HAMMITT. I think you would be greatly handicapped by your shutdowns and the necessity of the carrying on your overhead during that period of time, and by inefficiencies that are produced by a noncontinuous operation and by——

The CHAIRMAN. You yourself proposed that the way to run this plant was to operate it by secondary power instead of primary power.

Mr. HAMMITT. Oh, no; I said that if you are going to operate it by secondary power the most practical way was to shut it down during a part of the year.

The CHAIRMAN. Yes.

Mr. HAMMITT. But I do not see any such economies on power cost as would justify an operation on secondary power.

The CHAIRMAN. I think that is all, unless there is something further you want to say.

Mr. HAMMITT. Not a thing, Senator.

STATEMENT OF MILTON WHITNEY, CHIEF, BUREAU OF SOILS, DEPARTMENT OF AGRICULTURE, WASHINGTON, D. C.

The CHAIRMAN. To begin with, so you will be identified on the record, give your name and occupation.

Doctor WHITNEY. Dr. Milton Whitney, Chief, Bureau of Soils.

The CHAIRMAN. How long have you been chief of the Bureau of Soils, Doctor?

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Doctor WHITNEY. About 27 years.

The CHAIRMAN. What was your business prior to that time?

Doctor WHITNEY. Scientist, investigating soils and fertilizers.

The CHAIRMAN. Are you a chemist?

Doctor WHITNEY. Yes.

The CHAIRMAN. Were you engaged in the investigation of various chemical activities prior to your connection with the Bureau of Soils?

Doctor WHITNEY. Yes.

The CHAIRMAN. Where?

Doctor WHITNEY. Well, after my course at the Johns Hopkins University—a special course under Doctor Remsen—I was assistant chemist at the Connecticut Experiment Station in the fertilizer control. Then I was superintendent of the experiment farm at Raleigh, N. C., and then I was vice director of the experiment station in South Carolina, and then was at the Johns Hopkins University, cooperating with the Maryland Agricultural College and the Weather Bureau on soil investigation, and then came to the department about 27 years ago.

The CHAIRMAN. I think probably you had better say for the record, Doctor, whether you are interested in any way in any fertilizer operations in the commercial world?

Doctor WHITNEY. Not at all. I am not interested in any way in any fertilizer company, but only in a general way in the fertilizer investigations and in the fertilizer materials. I have no particular information with regard to Muscle Shoals. I have never been there and have only conferred with the War Department in connection with the operation of that plant when it was under their charge.

The CHAIRMAN. Which plant do you mean?

Doctor WHITNEY. The Muscle Shoals plant.

The CHAIRMAN. There are two there.

Doctor WHITNEY. I am particularly interested in the Haber.

The CHAIRMAN. In the Haber process?

Doctor WHITNEY. In the Haber process.

The CHAIRMAN. That is the one that did not pay down there?

Doctor WHITNEY. Yes; on account of the construction.

The CHAIRMAN. Now, Doctor, we are considering the Muscle Shoals proposition, and one important consideration, and one object Congress had in view at the very beginning, as shown by the statute when that place was selected, was to extract from the air nitrates with a view of making fertilizer, cheapening the product to the farmer. The first object was a war one. The peace part of it was to make fertilizer, or to make at least one of the principal ingredients of fertilizer, of which we were very short in this country.

The committee would like to hear from you on the practicability of the extraction of nitrates from the air, or anything, Doctor, that will be of interest in consideration of the general project, and we sent for you, because we consider you an expert in that line. Now, we would like to have you give us in your own way any information that you can in regard to the various methods, and the methods particularly there, which consist of the Haber process, which was not properly constructed and never was a success and also the cyanamid process, which was a success.

Doctor WHITNEY. Mr. Chairman, the general fertilizer situation in the country at present is the basis of the whole consideration—what we are using and what we need and how urgently we need it.

The present tonnage of fertilizers is approximately 8,000,000 tons a year. That varies from time to time. Last year, on account of economic conditions the production was about half of that—a little more than half. But 8,000,000 tons is what we consider the normal supply of fertilizers, and the cost to the farmer, according to the census for 1919, was $225,000,000.

Senator HARRISON. Was that a normal year?

Doctor WHITNEY. 1919 was about a normal year. In 1919 the estimated tonnage of fertilizers was 6,891,322 tons. In 1920 it was 7,654,239 tons. So that it was somewhat short.

Senator HARRISON. What was it just before the war?

Doctor WHITNEY. In 1913 it was 6,544,345. In 1914 it was 7,340,528.

The CHAIRMAN. Now, you are speaking, Doctor, about fertilizer, are you not?

Doctor WHITNEY. Well, I am speaking really of the fertilizer trade. There is no precise information as to how much is used by the farmers as fertilizer material.

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The CHAIRMAN. I have reference particularly to this tonnage that you have been giving us. Does that mean the fertilizer ready to be put on the ground?

Doctor WHITNEY. Yes; ready to put on the ground as it goes to the farmer.

Senator HEFLIN. Did you give the amounts for 1920 and 1921?

The CHAIRMAN. Yes; he did.

Doctor WHITNEY. I have given the 1920 figure. The 1921 figures were approximately 4,500,000 on account of the business depression.

Senator HEFLIN. A falling off of about half?

Doctor WHITNEY. Yes; for that one year. They expected a tonnage of about 8,000,000 tons that year.

Sesator HEFLIN. What was the tonnage for 1920?

Doctor WHITNEY. It was 7,654,239.

Senator KENDRICK. Do we produce any fertilizer that is exported, Doctor Whitney?

Doctor WHITNEY. Yes. We export phosphate rock.

Senator KENDRICK. But I mean the commercial fertilizer, ready to use?

Doctor WHITNEY. Well, acid phosphate. We produce some acid phosphate and export that.

The CHAIRMAN. Where do we get the phosphate rock?

Doctor WHITNEY. The principal mines are in Florida and Tennessee. The Florida fields supply all of the Atlantic Coast States east of the mountains. The Tennessee mines supply all west of the Allegheny Mountains.

Senator KENDRICK. We have hundreds of thousands of acres of it in Wyoming.

Doctor WHITNEY. The Wyoming field—the far western supply, of course, practically has not been touched, although they are now making what they call a double or treble super phosphate which runs about 60 per cent of soluble phosphoric acid, so as to be able to compete on freight rates with the more dilute material that they produce in the east.

The CHAIRMAN. How far from Muscle Shoals are the mines in Tennessee?

Doctor WHITNEY. Well, I have not been to Muscle Shoals.

The CHAIRMAN. Muscle Shoals is in northwestern Alabama.

Doctor WHITNEY. Yes; I understand. They are about fifty or a hundred miles.

The CHAIRMAN. Is it in such shape that it can be economically mined—the Tennessee supply?

Doctor WHITNEY. Oh, yes.

The CHAIRMAN. Now, Doctor, in considering the making of a completed fertilizer, does the freight on the phosphate rock cut quite a figure? Is that quite an item?

Doctor WHITNEY. Yes; there is freight right through every operation.

The CHAIRMAN. Then to make the most economical fertilizer it is desirable, I suppose, the supply of phosphate rock should be as near as possible to the place where it is manufactured?

Doctor WHITNEY. Yes. If I may give an illustration—of course, this was under war conditions—the ocean freight from Florida points I should say in the period 1918 and 1919 was about $6 a ton, or very nearly $6 a ton. It was about $5.75 a ton from Florida points to Baltimore, Philadelphia, and Carteret, N. J.—virtually New York—while the value of the material under some of the old contracts that were still in operation was less than $2 a ton. You see it became really a frightful condition, entirely distorted.

The CHAIRMAN. It was almost prohibitive?

Doctor WHITNEY. It was almost prohibitive.

Now, gentlemen, in the 8,000,000 tons of fertilizer that I am taking as what we may call a normal production, we use approximately 3 per cent of ammonia, 8 per cent of phosphoric acid and 3 per cent of potash. That makes, for 8,000,000 tons 240,000 tons of ammonia. That is what wes estimate that we use now—240,000 tons of ammonia, which is equivalent to 197,000 tons of nitrogen, or, in round numbers, about 200,000 tons of fixed nitrogen.

We use 640,000 tons of phosphoric acid in our national fertilizer bill. We use 240,000 tons of potash. Now, if we add those figures we get about a million tons. You get this statement: Out of 8,000,000 tons of fertilizers that are used by the farmers, the essential plant food constituents constitute 1,120,000 tons, and the natural filler—I don't say that it is an artificial filler, but the constituents that go with those materials that the farmers buy, and constituting for him waste product, is 6,880,000 tons. That is the amount of material which we ship over the country that is really not necessary.

These are chemical figures.

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Senator KENDRICK. Doctor, I don't like to interrupt you there, and I any more than I have to, but I do want to secure a little information on point of the waste material.

Would it not represent a great saving if this product could be deliver the farmer so that he could do the mixing at home and save the freigh expense of this waste material that is transported all over the country?

Doctor WHITNEY. Well, it could not be done at present. I will develop a little further. The present practice is such that we have been compell use low-grade materials. Now, when you come to using low-grade mat it is a question whether they can be shipped and handled by the farmer as as they can by the manufacturer, but there is a still deeper question than possibility.

I was going to say that these figures are expressed in chemical term would be safer to say that the fertilizers that our farmers buy carry some less than 2,000,000 tons of material they want and somewhat more than 6,0 tons of material that they do not need. Now, I made a rough estimate saving which would be made if we had concentrated fertilizers and could nate the unnecessary materials. I estimated that you would save $16,000,000 in the distribution from the fertilizer manufacturer to the fa Now, I did not attempt to estimate the difference in freight of the mater the fertilizer manufacturer. You see, there is a double charge that is into the fertilizer.

The CHAIRMAN. They ship it in to the manufacturer and then he ships i

Doctor WHITNEY. Then he distributes it. Now, I had the figures for bution, approximately—very reliable, I think—and we would save about 000,000 on freight.

The CHAIRMAN. Then it would be safe to say that the saving would be a more than that, would it not?

Doctor WHITNEY. Oh, yes. You would save on the bags. There would saving not only in the freight, in the collection or in the flow of the mat to the manufacturer and the distribution of fertilizer to the farmers, but would be a saving in the bags, and there would be a saving in the har charges. So that the actual saving would be more than the $16,000,000 t have given.

The CHAIRMAN. Doctor, is it not possible to teach the farmers to do thei mixing when they get the proper ingredients? Is it not possible to teach by bulletins from the Government?

Doctor WHITNEY. Senator, I think the question is a question of the c the service. I have always considered and have always told the fert manufacturers that it is perfectly possible for the farmers to mix their fertilizers. They can not mix it as well. It is not as uniformly mixed. can not take advantage of the market, as the manufacturer with capital Now, it is up to the manufacturers to perform this service of collectin materials and putting the fertilizer out to the farmer for such a marg profit, at such an expense that the farmer will say, "Well, I can get it r for so much; the service costs me so much, and I will not bother; I will bu mixed fertilizers."

It is precisely in the same situation that you found yourself years ago, you were young, Senator, when the housewife considered whether she w buy the cloth for the husband's clothes or for her own clothes or whethe would get them made by the tailor or get them ready-made, and a great families made their own shirts, their own clothes, and their own shoes. with the organization of these manufacturing interests it was found tha cost of service was so little that the difference in the cost of the materia of the finished article had such a narrow margin that the housewife said, " you can go down and buy your clothes. I can't afford to make them."

Senator KENDRICK. And it resulted in a superior article at that.

Doctor WHITNEY. A more uniform, better put together, more stylish ar and that is the way that thing went. I think it is the same thing with r to the home mixing of fertilizers.

The CHAIRMAN. But in the illustration you give, the only material tha put in in addition to the cloth was the thread and buttons and such as which constituted such a small part of the charge for transportation th would be impossible to compute it. Now, in the fertilizer proposition transportation charge is an enormous thing.

Senator HEFLIN. About three-fourths of the weight is the filler, as I u stand it.

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The CHAIRMAN. Yes.

Doctor WHITNEY. Well, we have not yet come to the question of our ability to make concentrated fertilizers. We are discussing now the question of whether the farmer can take this low-grade material that we are now using and mix it for himself, and there the question is of the cost of the service of the manufacturer.

Senator KENDRICK. Doctor, may I ask a question there?

Doctor WHITNEY. Yes.

Senator KENDRICK. It occurred to me to ask you as to whether or not there could be a filler, as you call it, used that would serve a useful purpose in the soil?

Doctor WHITNEY. Well, of course, it is claimed with regard to the organic ammoniates that the organic matter does have a value. Now, how far that claim can really be substantiated it is very hard to say, because experiments, the actual plot experiments that have been made, indicate about the same increase in crop production whether the nitrogen is applied in the form of nitrate of soda or ammonium sulphate, which have no organic matter with them or in the form of organic ammoniates, so that that is rather a debatable question. On the whole, I think it enters very little into the problem.

The CHAIRMAN. Now, Doctor, I would like to find out whether, as a practical proposition, this mixing could be done by the farmer. Now, I want to ask you, for instance, the ammonia that you are going to use now in making fertilizer, as I understand it, can not be used as ammonia in mixing it, can it?

Doctor WHITNEY. No. It has got to be fixed.

The CHAIRMAN. It has to be——

Doctor WHITNEY. Combined with something.

The CHAIRMAN. It has to be combined with something before you can mix it, does it not?

Doctor WHITNEY. Yes.

The CHAIRMAN. Now, what do you combine it with? Is it combined with a filler, or combined with something that is of some value itself as a fertilizer?

Doctor WHITNEY. Mr. Chairman, the substance that is produced in the Haber process, and one of the substances that would be produced from cyanamid, if cyanamid itself was not used as fertilizer, is ammonia gas. It is here in this bottle. It is an invisible gas; very pungent. If I took the stopper out of this bottle, the characteristic odor of ammonia would be very strong. It is ammonia gas. That in itself is utterly unfit for use as fertilizer in this gaseous state as it comes out of the Haber process. It can not be used in this state. Now, it has got to be mixed with something.

The CHAIRMAN. Apparently that bottle is empty.

Doctor WHITNEY. Yes; apparently it is empty.

The CHAIRMAN. Let me ask you, more as a matter of curiosity than anything else, does it weigh more than air?

Doctor WHITNEY. This is lighter than air.

The CHAIRMAN. So if you open it this bottle would weigh more than it does now?

Doctor WHITNEY. Yes, slightly more. Ordinarily that ammonia gas is absorbed in sulphuric acid, and that makes a solid white crystalline compound called ammonium sulphate.

The CHAIRMAN. That is what you have there?

Doctor WHITNEY. This is the ammonium sulphate that is made from the ammonia gas and absorbed in sulphuric acid. Now, the sulphuric acid has no particular value as a fertilizer. It is merely a carrier of this nitrogen. When ammonium sulphate is bought for fertilizer we buy only the nitrogen that it contains. This will answer your question, Senator Heflin. This then becomes a natural filler. It is worthless as a fertilizer. The sulphuric acid is worthless, but we have to use something to get this gas in a condition to apply or to mix with fertilizers.

What we mean by a concentrated fertilizer can be very nicely illustrated right here. We have been making investigations for a number of years on the recovery of phosphoric acid from our rock phosphate mines. The present method is to treat this rock with sulphuric acid. We treat one part of the rock with one part of sulphuric acid. The rock contains about 32 per cent of phosphoric acid. By treating a ton of it with a ton of sulphuric acid we dilute it to a 16 per cent phosphoric acid.

Now, that is one way in which we deliberately put a filler in that is of no particular value to the farmer. Now, instead of treating this phosphate rock with sulphuric acid to make the phosphoric acid more soluble we treat it with sand and coke. We mix the rock, sand, and coke and make a briquette, which has sufficient natural binding power to hold it together. That is smelted in a furnace, either an electric furnace or a

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fuel furnace which we are now working on, and that drives off the phosphoric
Instead of treating the rock with sulphuric acid we treat it with silicic acid or
from the sand. As soon as that melts it drives off the phosphoric acid, and we c
that as a liquid. Now, we have a liquid containing phosphoric acid. Here is
phoric acid that we buy for our fertilizers in a crystalline state. This is 100 pe
pure. Instead of mixing ammonia gas, obtained from the by-product coke
or from the Haber process, with sulphuric acid and making ammonium sulp
which carries a filler, we propose that we absorb this ammonia gas in this liquid
phoric acid and make ammonium phosphate, which is also a substance that c
mixed with fertilizers.

Now, the filler that is contained in here, which is necessary for the fixation o
monia gas, is of value because instead of being sulphuric acid, which the farmers d
want to buy, it is phosphoric acid.

The CHAIRMAN. Which they do want to buy?

Doctor WHITNEY. Which they do want to buy.

So that they want both parts of this. When they have the ammonium sulp
they only want one part.

The CHAIRMAN. After that is combined what percentage of the completed ferti
does it constitute?

Doctor WHITNEY. Now, that gives you a combination carrying 12 per cent of n
gen and 61.7 per cent of phosphoric acid.

Senator KENDRICK. Nearly 75 per cent.

Doctor WHITNEY. Yes; fully 75 per cent of ammonia and phosphoric acid.

The CHAIRMAN. But that is not, Senator, 75 per cent of the completed fertiliz

Senator KENDRICK. Is it not?

The CHAIRMAN. No; I did not understand that from his answer. That is m
the percentage of this compound.

Doctor WHITNEY. Now, Senator, we have ammonia and phosphoric acid. N
the Muscle Shoals plant is equipped to make ammonium nitrate.

The CHAIRMAN. Which plant are you speaking of now?

Doctor WHITNEY. That is the cyanamid plant. So that we have the ammoni
passed through an oxidizing process by which we get nitric acid. We have
talking about sulphuric acid and phosphoric acid. Now, we can get the nitric acid
combine this ammonia gas with nitric acid and then we get an ammonium nitra
very rich material) which you have heard of in connection with this Muscle Sh
plant, and which carries 35 per cent of fixed nitrogen. This can be mixed in
proportions with this ammonium phosphate. Then the further possibility is sh
of mixing with this phosphoric acid, potash salts. There are several ways in wh
that can be accomplished, but by mixing the potash with the phosphoric acid
get potassium phosphate, and then you have all three of the necessary fertilizer m
rials in the most concentrated form in which they are now produced. You h
nitrogen in the form of ammonium salts; you have nitrogen in the form of nitrate s
you have your phosphoric acid and your potash.

In these three forms they can be mixed together without any filler in the most
centrated condition that it is possible to secure.

Senator HEFLIN. Well, can not the farmer be taught to use so many parts of this
so many parts of that in making a ton of fertilizer?

Doctor WHITNEY. Ah! If you make it. But it is not possible to buy these thi
That is what we are talking about. It is not possible until we get these fixed nitro
products. You can take nitrate of soda——

Senator HEFLIN. That is what I am speaking about; but when you do get them.

Doctor WHITNEY. When you do; yes.

Senator HEFLIN. I am speaking about the situation presented at Muscle Sho
If that plant is developed down there so that it will make these fertilizers, then
it not be possible to supply this stuff to the farmer, and have him mix it, or hav
mixer in the county, where farmers can have the materials mixed, and save the frei
on the filler?

Doctor WHITNEY. Anyone can mix it. Here is a concentrated complete fertili
that I think maybe is 2–8–2, or, as you express it in the South, 8–2–2; that is, 8
cent of phosphoric acid, 2 per cent of ammonia, and 2 per cent of potash. Tha
made of ammonium nitrate, ammonium phosphate, and potassium phosphate.
contains in this form 12.29 per cent of nitrogen, 49.12 per cent of phosphoric ac
12.29 per cent of potash, and then it has some combined water. As it stands here
dilute that to the form in which it is sent to your cotton farmers, you would have
add 83.73 per cent of filler.

Mr. Chairman, that is the concentrated fertilizer idea.

The CHAIRMAN. Do you think it is a practical proposition there at Muscle Sho
to make that concentrated fertilizer as you have described it?

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Doctor WHITNEY. There is no question.
The CHAIRMAN. Can we do it down there?
Doctor WHITNEY. There is no question.
The CHAIRMAN. With either one of the processes?
Doctor WHITNEY. With either one of the processes. There would be some additions that you would have to make.
The CHAIRMAN. Well, now, can not that be done in any fertilizer-manufacturing establishment, excepting where they take the nitrogen from the air? Why don't the men now do that—the fertilizer people?
Doctor WHITNEY. Well, it is not feasible. They can not get the ammonia in the quantities. It could be done, but it would change the existing plants.
The CHAIRMAN. Well, I understand from one of the witnesses we have had here, where they utilize their water-power machinery over there in Canada and then ship it to different parts of the United States and complete its manufacture in a completed fertilizer, they are getting the nitrogen from the air.
Doctor WHITNEY. Yes.
The CHAIRMAN. Why can't they—they have the cyanamid process over there just the same as we have at Muscle Shoals—why can't they and why don't they, as a matter of economy, ship their fertilizer in concentrated form?
Doctor WHITNEY. Well, I will tell you. It is a very interesting thing, and rather an involved situation. One of the fertilizer companies has been making an ammonium phosphate. There is no sale for it. The double and treble superphosphate that is made from the Wyoming phosphate mines encounters difficulty in its sale when it comes in contact with 16 per cent acid phosphate from the Tennessee mines, because in order to make up a ton of 2,000 pounds of the low-grade fertilizers that the American farmer has been accustomed to use, they have got to buy filler at the factory and deliberately reduce the strength of the high-grade material in order to comply with the present standards of the fertilizer industry.
Senator HEFLIN. Doctor, in pounds, now, what proportion of the ton of fertilizer consists of filler?
Doctor WHITNEY. In this mixture I have shown you, 1,750 pounds.
Senator HEFLIN. My understanding is that somebody has testified here that it is 1,500 pounds.
Doctor WHITNEY. It is 1,750 pounds in this 2-8-2 mixture.
Senator HEFLIN. The filler?
Doctor WHITNEY. The filler.
Senator HEFLIN. So when the farmer pays freight on a ton of fertilizer he pays freight on 1,750 pounds of sand or something else.
Doctor WHITNEY. Not all sand. This is a natural filler. We don't want to imply that the fertilizer manufacturers have deliberately put things in, because they don't. They aim to avoid that. But what they do is to get very low-grade material and put that in.
Senator HEFLIN. Which is worth nothing as a fertilizer?
Doctor WHITNEY. Which is worth nothing as a fertilizer.
The CHAIRMAN. What is the filler composed of?
Doctor WHITNEY. Well, in the case of muriate of potash, 50 per cent of that is potash. That is what the farmers buy; 50 per cent is chlorine, which could be made into hydrochloric acid and sold to manufacturers who want it, but it is actually used in fertilizers, and the farmers are delivered something that they don't need and don't want.
The CHAIRMAN. What I am trying to get at is what is that something. Now, you have 1,750 pounds of filler in a ton of fertilizer?
Doctor WHITNEY. Yes, sir.
The CHAIRMAN. What does the 1,750 pounds consist of? You say it is not sand?
Doctor WHITNEY. No, it is not sand. In the case of cottonseed meal there is only 7 per cent of nitrogen—about 8.4 per cent ammonia. That is bought on the basis of the ammonia content. That ammonia is in the form of protein substances which are very valuable feeding constituents. The situation in the South to-day is that we can not afford to ship cottonseed meal to the Northern States, as we used to, for fertilizer purposes, because it is one of the lowest grade fertilizer materials we have, but as a feeding stuff, with 40 per cent of proteins, it is one of the most concentrated feeding stuffs that we have, and the material is going into feeding stuffs rather than into fertilizer.
Senator KENDRICK. During the fall of 1919 cottonseed cake, which is something like the same as meal, sold for from $80 to $100 a ton?
Doctor WHITNEY. Yes.
Senator KENDRICK. For feed for live stock?

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Doctor WHITNEY. Yes. During the war the question arose in the departme to whether we should not deny the use of cottonseed meal for fertilizers. I told no, not until they had a substitute for it, and that is the situation now. The co seed meal and cake is going into feeding stuffs and slaughterhouse tankage is into feeding stuffs; dried blood is going into feeding material. It is a very valu very concentrated animal food, and a low-grade fertilizer material. As the getting more careful in their preparation, so that it is fit for animal consumpti is going more and more into that use, and this will be withdrawn to a very large e from fertilizer use. Their use is now being contracted for fertilizers and we something to take their place.

The CHAIRMAN. To get back to my question again, a ton of completed fert contains 1,750 pounds of filler and 250 pounds of fertilizer. Why could you n sand for that filler? What is the objection to it?

Doctor WHITNEY. Well, there is no objection if it is known what you are doing we do not need it if we can get a low-grade material like this. You do not nee sand, because every 100 pounds of this one contains 7 pounds of nitrogen. Y not need any sand if you select a low-grade material. You do not need to add a

Senator HEFLIN. Is sand a good filler?

Doctor WHITNEY. Yes, sir; for a diluent.

SENATOR HEFLIN. Would sand be more costly than this low-grade filler tha are speaking about?

Doctor WHITNEY. Yes; I think so. I think they figure that they would rather the rock shipped from Florida, the phosphate rock shipped from Florida wit natural filler it contains of lime, than to concentrate that at the mines and send in a concentrated form and then buy sand near the factory.

The CHAIRMAN. That is what I was trying to get at, Doctor. I was talki Major Burns here.

Major BURNS. I don't believe the Senator has realized that a great part o filler is sulphuric acid, which you can not possibly eliminate.

Doctor WHITNEY. You can not eliminate it.

Major BURNS. He would like to know what part of that is filler which can n eliminated and what part is filler that is put in.

Doctor WHITNEY. Oh, they don't put much in. It is this natural filler that telling you about. The only way to get rid of that is to offer the material tha farmer wants fixed in some other form. Instead of giving him ammonium sulp give him ammonium phosphate.

The CHAIRMAN. You say the completed fertilizer contains 1,750 pounds of fil material which does not do the farmer any good.

Doctor WHITNEY. Well, I told you in the case of cottonseed meal only 7 per ce that does he value at all in his fertilizer. The other 93 per cent is organic m natural organic matter. The nitrogen content is only an incidental part of the material. Is that clear, Senator?

The CHAIRMAN. No; I confess I don't quite understand. We have got 1,750 po in every ton that is no good, and you have to have something—it don't make difference what that 1,750 pounds is composed of, so long as it would not do any

Doctor WHITNEY. But you don't have to have that 1,750 pounds. It can be e nated.

The CHAIRMAN. Then we ought to eliminate it if we can.

Doctor WHITNEY. It is eliminated in this mixture that I showed you.

The CHAIRMAN. But you are not able to get that mixture on the market now you?

Doctor WHITNEY. Well, no; simply because the material is not prepared on a mercial scale.

The CHAIRMAN. I can not understand, then, why they do not prepare it on a mercial scale and use it for fertilizer instead of using such a large percentage that not do anybody any good but is expensive to handle.

Doctor WHITNEY. Senator, it is because the fertilizer industry has from the first a scavenger industry. It has not been on a chemical basis. They have been util these waste products. Now, they are using garbage tankage for fertilizer purp I would say rather that they are using base goods, not garbage tankage, but goods. That is, they are taking on shavings and hair and felt hats and all so material.

The CHAIRMAN. Old shoes?

Doctor WHITNEY. Old shoes that the States prohibit in their original forms be they are so inert and so useless. They are taking those now and putting them in acid chambers, and they are acted upon and their form is entirely lost. They com a sort of soup, and that material is permitted in fertilizers, and the nitrogen is p cally just as effective as any other form of nitrogen but that material only has

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cent of nitrogen in it. We call that a low-grade material. Ninety-eight per cent of the material in there is part of the original leather, part of the original hair, or part of whatever you choose that has never been separated from it.

Now, in the case of coal that you coke, there is 2 per cent of nitrogen in coal. You would not think of applying coal to your land, because the nitrogen is unavailable. What they have to do is to process that coal. They coke it and in the coking products are given off—tars and gases—and out of that gas comes this ammonia. The nitrogen is converted to ammonia, and by going through that by-product coke oven the nitrogen is segregated into ammonia gas.

Senator KENDRICK. But the coke is destroyed, is it?

Doctor WHITNEY. The coke is used for the iron industry and the tar is used for the dye industry. So that you have segregated that and also utilized what would have been a natural filler and worthless material to the farmer.

Senator HEFLIN. Now, then, Doctor, after you get these fertilizer ingredients as you have them here, and you mix them together, then a ton will be a ton of fertilizer?

Doctor WHITNEY. A ton will be a ton of fertilizer, and a ton of that material will be equivalent to about 5 tons of our ordinary fertilizer.

Senator HEFLIN. And this filler that we have been discussing will be eliminated?

Doctor WHITNEY. Will be eliminated.

Senator KENDRICK. Doctor, you have stated that the manufacture of commercial fertilizer has proceeded on a scavenger basis.

Doctor WHITNEY. Yes, sir.

Senator KENDRICK. Is it not true that that has been based on the impression that this filler, so-called worthless material, has had a value?.

Doctor WHITNEY. Well, there is really no claim to that.

Senator KENDRICK. I thought the commercial fertilizer manufacturers did claim great value for this material that they use out of stockyards and——

Doctor WHITNEY. Yes; they make a claim, but it is not bought on that basis.

Senator KENDRICK. I thought it was sold on that basis.

Doctor WHITNEY. No; it is not sold on that basis. The market price of the organic ammoniates up to the period of the war was set by the price of nitrate of soda in the markets of the world. Now, there was a fluctuation. They would go up or they would go down with respect to each other, according to market conditions. But the price of nitrogen in nitrate of soda was a controlling influence on the price of organic ammonia, and it was not until the value of these wastes products for feeding stock was recognized during the middle part of the war, when they parted from each other.

Now they talk a great deal about the value of the organic matter, and in a way I think they are right. They do not practice it. When you buy your fertilizer you buy it on the——

Senator KENDRICK. Well, does that mean that fertilizer has been analyzed and is consumed as it is sold according to the values of these nitrates and other products?

Doctor WHITNEY. No; as carrying certain proportions. The fertilizer is marked with the amount of nitrogen it contains, and very seldom does it carry the information as to the source of that nitrogen, so the farmer does not know whether he is buying one form or another. It is sold to him as so much nitrogen, on the basis of so much nitrogen, so much phosphoric acid, and so much potash.

Mr. Chairman, I speak of the fertilizer industry mainly as a scavenger industry. The first things that were handled were bones on the farms, bones of animals, that were treated with sulphuric acid to make them readily available, in Scotland about 1780, I should say. Before that phosphorus was a curiosity. It was hardly known. Potash-potassium had not been discovered in 1800. You see our knowledge of chemistry, and our progress, is really very recent. Now, the commerical fertilizers, the discovery of the rock in the mines of South Carolina and Florida, was made in about 1869, and their treatment with sulphuric acid started a great development of the sulphuric-acid industry, and we have an immense development of the sulphuric-acid industry for the treating of rock phosphate. Two million tons of sulphuric acid are made annually in order to treat 2,000,000 tons of phosphate rock. Now the companies are tied up with this equipment. They have their investments in this equipment. It is only because of this new development of the fixation of atmospheric nitrogen in the form of ammonia that has enabled us to use the products of fixed nitrogen factories in our ordinary commercial fertilizers that is making it possible now to make a fresh start and put the fertilizer industry on a strictly chemical basis.

So far as we know, Mr. Chairman, the only source of our fixed nitrogen has been the sun and the growth of plants. It is the plant itself that fixes, through the influence of the sun, this nitrogen as a part of its component body. The nitrogen that we get from the cottonseed meal is a plant process. The nitrogen that we get out of fish scrap is an animal process. The nitrogen that we get out of coal in our coking process comes from the plant that grew ages ago.

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So far as we know, the nitrogen of the sodium nitrate was originally fixed by pl so that the only source of fixed nitrogen that we have had in the past has been thr the action or agency of plants or of animals.

Now, 20 years ago, Sir William Crookes notified the world, in an address befor British Association that unless some means could be found of fixing nitrogen wheat crop of the world would not be sufficient to support the increasing popula Even since then, the scientists of the world have been working on the possibili fixing the nitrogen of the air. The war has given the greatest possible stimul these matters.

We ourselves, in the Bureau of Soils, had the Haber process equipped whe War Department was seeking for nitrogen, for supplies of fixed nitrogen. Tha one of the most promising methods. There are several methods, but the Haber ess appealed to us as the most promising of all the methods. The cyanamide me is somewhat cheaper and is already in effect. These methods have been devel by mankind.

Now, the methods of fixing this atmospheric nitrogen make it necessary for add something to the product that will make it available for agriculture, and i question of whether you will use sulphuric acid or phosphoric acid before you make the ammonium nitrate, or whether you will make potassium phosphate, which are possible with these fixed nitrogen plants, or whether you will go on the scavenger industry that the fertilizer is to-day.

Senator KENDRICK. Doctor, is it your opinion that anything like perfectio been reached in the processes?

Doctor WHITNEY. No; I would not say that. There is no question about p tion. It is something that the world has got to work out. It is going to be imp right along. It is not perfect; none of the methods are perfect now, and none products are wholly satisfactory. We want to improve them; we want to im the methods, but the possibility of utilizing these methods on a commercial sca come through. That is well worked out.

Senator KENDRICK. That ought to guarantee increased efficiency in the futur

Doctor WHITNEY. It ought to start the fertilizer industry as a real chemical indu We can make the cyanamide. That is one of the products, but cyanamide is no adapted to our present practice of mixed fertilizers. You can also put a little, 60 pounds, of cyanamide in your mixed fertilizer. It is impracticable for the m facturer to use it in larger quantities. The ammonium sulphate can be used. is something which we are familiar with.

Senator KENDRICK. Has there been a great improvement in the processes the war?

Doctor WHITNEY. Oh, yes; a very, very pronounced improvement. The fo governments are quite well ahead in these matters, but they will be improved, as everything else.

The CHAIRMAN. What foreign government does the most of it, Doctor?

Doctor WHITNEY. So far as I am informed, the German Government. The ahead during the war with their practice.

The CHAIRMAN. They, during the war, supplied themselves with nitrates fro cyanamid and Haber processes, did they not?

Doctor WHITNEY. Very largely; yes, sir.

The CHAIRMAN. And are they operating now for fertilizer?

Doctor WHITNEY. Yes, sir; they are operating them now for fertilizer.

The CHAIRMAN. Have they anything in either one of those processes that w not familiar with? Are there any secrets that we do not know about?

Doctor WHITNEY. Yes; the whole thing has been done by all the government secretive way, and there are secrets iin regard to details, though not in regard essential things.

The CHAIRMAN. Well, are those secrets such that they cheapen the product?

Doctor WHITNEY. Yes.

The CHAIRMAN. Then, we can not make this product as cheaply as Germa that the truth?

Doctor WHITNEY. No; I would not say that. Of course, you have a differe your labor costs, and in your living and things of that kind, but we can m here, I should say——

The CHAIRMAN. Germany seemed to be utilizing the cyanamid process ther was using coal as fuel for power, which our scientific men believe is not a pract proposition in this country.

Doctor WHITNEY. Yes.

The CHAIRMAN. That the power expense alone would make it prohibitiv fertilizer. Why is it that Germany can do it and we can not do it? Does it al in in the cost of labor? Is that the only difference?

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Doctor WHITNEY. I think so. Germany has to do those things. She has limited supplies. She has to make the product. Then, there is another thing, Mr. Chairman, in connection with the German competition in chemical industries that, I think, perhaps we have not fully realized. The German workmen is trained in chemical schools. He is trained in chemical works. A large part of the industries of Germany are along chemical lines. The workmen are trained to such methods of manipulation. When we build a factory in this country, we get workmen there. Well, they are of all kinds. They may have been on the railroads, or they may have been in the mines, or they may have been in the cotton factories; but when the German build a factory they have a supply of labor—no better trained than ours, perhaps, but who have had a special training in chemical manipulation; so that the laborer that we get does not know anything about what he is doing, but the laborer that the German manufacturer gets has a certain technique that fits him at once for that particular place, although it may be an entirely different chemical industry from what he has been theretofore engaged in.

The CHAIRMAN. Have the German educational chemical institutions been superior to ours?

Doctor WHITNEY. Yes; they have been much more concentrated.

The CHAIRMAN. Take the Haber process and compare that with the cyanamide process in Germany. Which do they utilize the more there?

Doctor WHITNEY. Well, it is a little difficult for me to say, Mr. Chairman, but I think that I might say this, that the judgment of the world is that the Haber process is the better one.

The CHAIRMAN. The more economical?

Doctor WHITNEY. The more economical, provided you can get your materials.

Senator KENDRICK. Is the product substantially the same?

Doctor WHITNEY. In a way, yes. In Europe it is a common practice to apply fertilizer materials. They do not have the mixed fertilizers that we have. Their principal fertilizer manufacturer is the acid phosphate manufacturer, who manipulates the rock into the soluble form of acid phosphate. The other constituents are not mixed together. They apply their nitrate of soda or their cyanamide or their potash salts at different times when, in their judgment, they ought to be applied. Now, they have used cyanamide rather successfully. There is one school of scientists in Europe which is very strongly in favor of the use of cyanamide, but they use it by itself. There is another school that is very largely opposed to it. Now, I think there is no doubt that there are soils on which cyanamide does not do well. There are other soils on which it does. It is an uncertain proposition. It is a complicated thing that may break down in one way, which will be beneficial to plants, and it may break down in another way which will be just the opposite.

The CHAIRMAN. Then, after all, we would be confronted with the question in this country as to whether cyanamide would be a success on our soil, or we may have some soils where it would be a success and some where it would not.

Doctor WHITNEY. I think, Mr. Chairman, cyanamide will not be taken as satisiactory by the American farmers. I do not think they would touch it. The fertilizer manufacturers can not use it with their present form of acid phosphate.

The CHAIRMAN. Does that mean that, in your judgment, the operation of this cyanamide plant down there as a fertilizer proposition would be a failure?

Doctor WHITNEY. Oh, no; not at all. What is fixed down there is nitrogen. You are talking about how much ammonium sulphate you can make and how much ammonium nitrate you can make and how much cyanamide you can make. What you really do is to fix nitrogen. That plant is designed to fix 40,000 tons of nitrogen per annum. Is not that so, Major Burns?

Major BURNS. Yes, sir; 40,000 tons per annum.

Doctor WHITNEY. That fixed nitrogen has to be manipulated in some way in order to make it useful and acceptable to the farmers of this country as a fertilizer. One thing is to use the cyanamide as it is produced and finished down there. In my judgment it will not be used by the fertilizer manufacturers and I do not think the farmers would be satisfied to use it under the conditions under which they would have to use it.

Now, the next thing is to see how to get the fixed nitrogen out into a form in which it will be most valuable to the farmer. The cyanamide process appears to be the cheapest process for the fixation of atmospheric nitrogen. That is the preliminary thing to be done.

Now, that nitrogen can be turned from the form of cyanamid into the form of ammonia; so that at that point you parallel the Haber process, if you get your ammonia from your cyanamid, and you get your ammonia from your Haber process, from there on everything is along parallel lines. The only thing is that the ammonia is fixed as ammonia by the Haber process; that is, the hydrogen and nitrogen are

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directly combined; but with the cyanamid process you go through this interm stage, in which form carbide and then cyanamid, and finally ammonia.

Senator KENDRICK. If I am not mistaken, you have shown us, Doctor, a f compound there that includes all of the necessary chemicals used in fer have you not?

Doctor WHITNEY. Yes, sir.

Senator KENDRICK. All in one compound.

Doctor WHITNEY. Yes, sir.

Senator KENDRICK. In one compound?

Doctor WHITNEY. Well, in one mixture.

Senator KENDRICK. Yes.

Doctor WHITNEY. Yes.

Senator KENDRICK. I am not certain as to whether it was your opinion, or wh or not you made the statement that we might come to the time when we woul duce that commercial fertilizer in that form without the filler.

Doctor WHITNEY. Yes.

Senator KENDRICK. Is that true?

Doctor WHITNEY. Yes, sir.

Senator KENDRICK. And that would eliminate the waste in freight rate an necessary difficulties of handling, and all of that?

Doctor WHITNEY. Yes, sir.

Senator KENDRICK. And would mean a greatly increased economy in the this fertilizer?

Doctor WHITNEY. Yes, sir.

Senator KENDRICK. That sort of preparation, however, has not yet bee veloped; at least they have not reached the point where they can prepare that mercially?

Doctor WHITNEY. Yes; that is true. Well, they can do it and they are doi Now, there is a factory operating in the South that is producing phosphoric aci liquid phosphoric acid, and is making the double acid phosphate. It is prepa make the ammonium phosphate and the potassium phosphate, but is not pre to make the ammonium nitrate that would have to go in to fortify the nitrogen co Now, there are partial developments, you see, but the complete development h been perfected.

Senator KENDRICK. Assuming that they could prepare this in form for actua what amount of weight would be eliminated from the ton—1,750 pounds?

Doctor WHITNEY. Yes. Well, in the case of this particular formula that I sh you 83 per cent—practically 84 per cent of the weight of ordinary fertilizer wou eliminated.

Senator KENDRICK. Yes. That would mean that this fertilizer prepared i form would have about five times the efficiency——

Doctor WHITNEY. Yes, sir.

Senator KENDRICK. In rejuvenating the soil that the present form of fertilize

Doctor WHITNEY. Yes.

Senator KENDRICK. Is that about it?

Doctor WHITNEY. Yes; that is the idea.

Now, the question has arisen as to how farmers are going to apply a small amo concentrated material. They can do that in one of several ways. They can ap directly, just as they apply straight nitrate of soda and acid phosphate at the p time. The farmers are used to distributing materials in small amounts per Look at the way they distribute so uniformly a few pounds of clover seed.

Senator KENDRICK. Yes; and the finest form of seed, the smallest seed.

Doctor WHITNEY. Yes, sir; the smaller seeds. They apply a few pounds to the They can apply a uniform dressing of a concentrated fertilizer, but——

Senator KENDRICK. Is it not true that we now have machinery that could be in such application?

Doctor WHITNEY. Yes, sir; we have machinery that is not any too satisfactory. fertilizer spreaders are not very satisfactory, even for the present diluted form we use. There is no doubt but what they could be improved, and if the necessity I think there is no question but what the farm machinery men would put out a m spreader that would spread uniformly even small amounts of material. If the f does not want to use his concentrated fertilizer then he himself or the local deal mix it with sand, and in the case of the truck farmers, and the tobacco farmers they use very large applications, the material can be applied in solution and sp just as they spray their orchards, although they would spray their soil.

The CHAIRMAN. Doctor, how does the fertilizer, composed, as you say, of compare with the ordinary farmyard manure that is spread on the soil?

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Doctor WHITNEY. Well, the farmyard manure is unique. It has always been considered the most beneficial thing that can be applied, but, unfortunately, there has never been an adequate supply, and right now there is a diminishing supply.

The CHAIRMAN. Well, the farmer could control that to some extent, could he not?

Doctor WHITNEY. Yes; but you can not keep your animals just for the sake of the manure. It is a waste of product.

The CHAIRMAN. No.

Doctor WHITNEY. As in the case of the amount of cottonseed meal.

The CHAIRMAN. Would not the ordinary farmer be better off, though, if, instead of devoting all of his energies to raising wheat and corn, he would keep some stock?

Doctor WHITNEY. That is undoubtedly true, but the amount that would be required per acre of cultivated land that they had would be greater than——

The CHAIRMAN. If they raised wheat and utilized the straw, then they themselves would be able, to some extent at least, to control the amount of manure that they would be able to apply to their land.

Doctor Whitney. Well, it is certainly a thing to be greatly desired; yes.

Senator KENDRICK. In connection with the chairman's question, Doctor, about the relative value of the fertilizers that can be had on the farm, and are derived from the live stock, is it not true that one of the advantages of that form of fertilizer is that it does not leach out in the soil, that it tends to build the soil up more than the chemical forms?

Doctor WHITNEY. Yes, sir; there is an advantage of that kind.

Senator KENDRICK. It seems to me, as I recall from some of our earlier hearings, the statement was made by some one of the committee that these chemicals applied to the soil, however much in quantity, are only of a temporary benefit because they leach out of the soil. Is that true?

Doctor WHITNEY. Well, Senator, the most reliable information of that kind has been gained by the Rothamsted experimental station in England over the past 70 years. As I recall this offhand, where stable manure has been used continuously, the yield of crops of wheat has increased up to 30 bushels per acre. It took about 10 years to obtain that increase; that is, it was each year a few bushels, until at the end of 10 years the yield was 30 bushels. Now, they continued that for 10 years, and that yield was maintained with annual applications. At the end of these 10 years they divided their field, and stopped the use of all manure on part, but on the rest of the field they continued it. For 70 years now manure has maintained that yield of wheat.

Senator KENDRICK. Seven years?

Doctor WHITNEY. Seventy years. It took 10 years to——

Senator KENDRICK. Did you say 70 years?

Doctor WHITNEY. Seventy years; yes.

Senator KENDRICK. That is remarkable.

Doctor WHITNEY. But they had to use it every year. Now, in this half of the field that they stopped the use of it on, the yield immediately began to fall, and in 10 years it had come back to the original yield; that is, it took as long to increase the yield as it did to decrease it after the application stopped; but with a continual use, they maintained it.

The CHAIRMAN. Now, can you compare that with commercial fertilizer?

Doctor WHITNEY. In the case of the commercial fertilizer, they have also been able to obtain a yield of around 30 bushels. I have not the exact figures here, but approximately the same. It took about eight years to get that yield up with commercial fertilizers. Then, it was maintained——

Senator HARRELD. Did they start out on the same basis?

Doctor WHITNEY. They started in the same year. Yes; these were started 70 years ago.

Senator HERRELD. I mean as to the production in the beginning?

Doctor WHITNEY. The same field.

Senator HARRELD. The same field?

Doctor WHITNEY. The same field; yes.

Now, at the end of 10 years the increase was maintained, but the plots without any fertilizers, which they had used as their control plots, went down; so that what happened was that this yield went up for 10 years, and then it began to go down, but always maintaining the same increase over the unfertilized plots.

Senator KENDRICK. That is not quite clear to me, somehow.

Doctor WHITNEY. That is a little difficult to understand.

Senator KENDRICK. And I want to understand it, too.

Doctor WHITNEY. Yes.

Senator KENDRICK. You say that the yield was increased over a period of 10 years?

Doctor WHITNEY. Yes.

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Senator KENDRICK. With the prepared fertilizer?
Doctor WHITNEY. Yes; that was the increase over the unmanured plot.
Senator KENDRICK. Yes.
Doctor WHITNEY. Yes; it was.
Senator KENDRICK. Then what happened?
Doctor WHITNEY. Then the increase was maintained with respect to the check do you see?
Senator KENDRICK. Yes.
Doctor WHITNEY. But as the check plots were falling, were losing in product the actual yield under the fertilizer became less and less.
Senator KENDRICK. That is, the fertilizer became less effective each year.
Doctor WHITNEY. It was just as effective as regards the difference betwee unfertilized plots, but, as the check plots that they were comparing it with wer ing, the yield under the fertilizers also fell.
Senator KENDRICK. Yes.
Doctor WHITNEY. And the fall began at this period of about 10 years after began to apply it.
The CHAIRMAN. I think it is plain about the manure fertilizer that you ap there, but just what happened to the commercial fertilizer? They commenc apply it every year, and at the end of eight years it got up to 30 bushels per ac
Doctor WHITNEY. Approximately 30 bushels per acre; yes.
The CHAIRMAN. Now, at that time they divided it the same as they did i other experiments?
Doctor WHITNEY. No.
The CHAIRMAN. And a part of it they continued to apply it to?
Doctor WHITNEY. No; not the commercial.
The CHAIRMAN. Not the commercial?
Doctor WHITNEY. No.
The CHAIRMAN. It is to be regretted that they did not perform the same e ments that they did with the other.
Doctor WHITNEY. Yes.
The CHAIRMAN. They continued to apply it, then, on the commercial?
Doctor WHITNEY. Yes.
The CHAIRMAN. And notwithstanding its application, at the end of 10 ye commenced to go down?
Doctor WHITNEY. At the end of 10 years it commenced to go down.
The CHAIRMAN. How many years did it take it until it got back to where started?
Doctor WHITNEY. Well, the fall in the yield of the fertilized plots was propor to the fall in the yield of the check plots.
The CHAIRMAN. That is, those that were not fertilized?
Doctor WHITNEY. Those that were not fertilized; yer, sir.
The CHAIRMAN. Still the fertilized was higher than the unfertilized?
Doctor WHITNEY. Yes.
The CHAIRMAN. Both going down?
Doctor WHITNEY. Both going down. That is it exactly.
The CHAIRMAN. Yes. Now, what I want to know, is how long did it take th tilizers on the way down to get back to where they started?
Doctor WHITNEY. They have not gotten back yet.
The CHAIRMAN. They have not gotten back yet?
Doctor WHITNEY. The fall of the checked plots was from, I think it was, origin bushels, to 9 bushels. I think those are the figures. The fertilized plots hac parallel to those, except for this initial rise of the preliminary 8-year period. then it has been parallel.
Senator NORBECK. What is the conclusion, Doctor—that you can not maints fertility with commercial fertilizers; is that it?
Doctor WHITNEY. No; I think it is a little different from that. The lesson draw from that is——
Senator KENDRICK. Is it the answer that it requires more and more of it?
Doctor WHITNEY. No; I think the answer is that you can not lay down a progra farmer that is to be followed without any variation for 70 years any more than y lay down a program for a horse or for a cow that is to be followed without va during its lifetime.
The CHAIRMAN. Now, let us see about that. All of this time they have been wheat?
Doctor WHITNEY. Yes.
The CHAIRMAN. Nothing but wheat?

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Doctor WHITNEY. Nothing but wheat.

The CHAIRMAN. Does it not demonstrate that with the commercial fertilizer you can not always keep on raising one crop, but you have to put it into something else?

Doctor WHITNEY. Yes, Mr. Chairman. I have asked the gentlemen in charge of these experiments the reason for that. I said, "What has been your experience; during these years how has the soil behaved?" They said, "They have filled up with weeds; under some of these experiments they have become hard and difficult to handle; some of them have run together; some of them have become acid." I said, "Well, that is exactly the pitfall the English farmer has avoided. He has been raising wheat; 300 years ago he got only 12 bushels per acre; he is now getting 30 bushels per acre, and he has seen the necessity, during a period of 70 years, of changing his farm operations. If he feels it is becoming weedy, he changes his crop; he changes his cultivation if he feels it is becoming hard; and so they have avoided these pitfalls that these long-time fertilizer experiments have led us into."

Senator HARRELD. Doctor, would not the nature of the chemical fertilizer used cause a variance in the effects on the soil?

Doctor WHITNEY. Yes; undoubtedly, and by changing the nature of the mixture you can do much to——

Senator HARRELD. All that has been the result of experiments of scientists to get good results.

Doctor WHITNEY. Then, again, you must not forget that it is the kind of crop you are growing and it is the order of rotation. This work was done with a single crop—wheat—grown continuously for 70 years. They have another field there which they have rotated for 50 years in wheat, turnips—a four-year rotation; I do not recall the crop now—without any application of fertilizer at all, they have maintained a yield of 26 bushels.

The CHAIRMAN. Of wheat?

Doctor WHITNEY. Of wheat.

The CHAIRMAN. They put in a crop of wheat every four years?

Doctor WHITNEY. They put in a crop of wheat every fourth year, and the average of those crops is within two or four bushels of the average of the fertilized crops in those same years.

The CHAIRMAN. Where they continued to raise the same thing every year?

Doctor WHITNEY. Where they continued to raise the same thing.

Senator KENDRICK. You spoke a moment ago about fixing nitrates with different forms of plants cultivated. Is it not true that alfalfa is the greatest plant——

Doctor WHITNEY. Yes.

Senator KENDRICK. For such a rejuvenation of the soil?

Doctor WHITNEY. Yes; that is one of the best of the leguminous plants.

Senator KENDRICK. I once heard a man ask a question as to how long the alfalfa roots were. The answer was that he did not know, but the longest one he had ever seen was singed off at the lower end. [Laughter.]

The CHAIRMAN. Well, that demonstrates where he was. [Laughter.]

Senator HEFLIN. So it is necessary, Doctor, to have crop rotation; it does not make any difference what kind of a fertilizer you use?

Doctor WHITNEY. Oh, yes. Fertilizer is one method. You can not avoid these others. You have to use good cultivation; you have to use rotation of crops; you have to do good work all along the line. Fertilizer is not going to do it for you unless you follow it up and help it out.

Now, the best results they have obtained in those English experiments are where they have used rotation of crops and fertilized it.

Senator KENDRICK. Now, coming to the point with reference to Muscle Shoals, is it your opinion that it would be possible and practicable to manufacture chemicals there that are employed in the production of fertilizers? Is it your opinion that that will prove a practical success, is it?

Doctor WHITNEY. Yes, sir.

Senator KENDRICK. Have you given any thought as to what kind of power it would be necessary for us to use in such processes, whether it would be primary power or secondary power?

Doctor WHITNEY. No; I would not say as to that.

Senator KENDRICK. Have you estimated as to whether it would be possible to make such a production profitably with primary power?

Doctor WHITNEY. Well, I would not like to go into that, Senator. That would be an engineering proposition.

Senator KENDRICK. Yes.

Doctor WHITNEY. I can say that our investigations at the bureau—and we have investigated along all of these lines, on the scale that we have been able to work

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with—are such that we believe that these materials can be made with a profit o
basis of the present cost of fertilizer materials.

Senator KENDRICK. Well, under an increased improvement in method, particu
toward the elimination of waste material?

Doctor WHITNEY. Yes. Mr. Chairman, I would say that it is a question n
this committee to determine. It is a question that nature itself is going to force
us, that we have not an adequate supply of nitrogen, of fixed nitrogen.

The CHAIRMAN. Right on that point, Doctor, I would like to ask you a qu
or two.

Every fertilizer has to have three chemicals, as I understand it?

Doctor WHITNEY. Yes.

The CHAIRMAN. One is nitrogen?

Doctor WHITNEY. Yes.

The CHAIRMAN. One is potash?

Doctor WHITNEY. Yes.

The CHAIRMAN. And the other is phosphoric acid?

Doctor WHITNEY. Phosphoric acid.

The CHAIRMAN. Now, the plants down there are equipped to make only o
those ingredients, and that is the one in which we are particularly short in the
as I understand it.

Doctor WHITNEY. Yes.

The CHAIRMAN. That is nitrogen.

Doctor WHITNEY. That is what we have to have.

The CHAIRMAN. To get the nitrogen, we get ammonia.

Doctor WHITNEY. Yes.

The CHAIRMAN. I wish you would tell us, if you can, what is the cost to the f
of the ammonia that is in his fertilizer? Confine it to that one ingredient th
are going to get out of the air. Take, for instance, what I understand is the or
necessity, or at least the ordinary production, about eight million tons of fertili
a year.

Doctor WHITNEY. Yes.

The CHAIRMAN. How much of that 8,000,000 tons, or what does it cost in
8,000,000 tons to supply the ammonia or the nitrate?

Doctor WHITNEY. Mr. Chairman, I could give you those figures. I have th
portion of nitrogen that comes from different sources. I have the wholesale
of those materials. I have the total amount of nitrogen or ammonia that is us
that I could figure it out for you if you wish it.

The CHAIRMAN. I wish you would figure it out.

Doctor WHITNEY. Yes.

The CHAIRMAN. Can you do that for us?

Doctor WHITNEY. Yes.

At your request I would state that at present prices for fertilizer materials, th
to the farmer of 240,000 tons of ammonia, which is the estimated amount used
annual consumption of 8,000,000 tons of fertilizers, would be approximately
094,000, this figure including the wholesale cost, manufacturing costs, and s
and distribution costs.

The CHAIRMAN. Now, I want to ask you another question: Have the farmers
getting enough fertilizer; is 8,000,000 tons enough to supply them, or ought th
have more?

Doctor WHITNEY. They ought to have more.

The CHAIRMAN. How much more?

Doctor WHITNEY. Well, I have estimated that if the commercial wheat and
crops were fertilized as they should be, we should probably use at least 16,0
tons.

The CHAIRMAN. Then, we ought to double it?

Doctor WHITNEY. We ought to double it.

The CHAIRMAN. Do you suppose that if the price were reduced, the farmers
double it? Could it be demonstrated, for instance, by your department, that it
be financially profitable for the farmers to double it?

Doctor WHITNEY. Yes; it would be if we had the material.

The CHAIRMAN. I understand that.

Doctor WHITNEY. Yes; but one of the reasons why the department has not exp
or pushed the use of fertilizers west of the present line of intensive use is becau
really have not got the material. I told one of the fertilizer manufacturers som
ago that if we had the material, if we had the fixed nitrogen—we have plenty o
phoric acid, and we can get plenty of potash, but are lacking in fixed nitrogen-
had sufficient of it to justify a campaign of education the farmers of the United
could profitably use twice as much as we now have.

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The CHAIRMAN. Now, Doctor, there is not——

Doctor WHITNEY. We are limited only by the nitrogen supply.

The CHAIRMAN. Could the people who are making the fertilizer, with their present machinery and present capacity, double their output?

Doctor WHITNEY. No, sir; they have a capacity now of about 10,000,000 tons.

The CHAIRMAN. And they have made about 8,000,000 tons?

Doctor WHITNEY. About 8,000,000 tons.

The CHAIRMAN. If we operated plant No. 2 down there—and that means the cyanamid one, to its capacity, would there be a surplus then of fertilizer in the country? Would there be more than the farmers would be able to use, provided the commercial people did the same as they are doing now?

Doctor WHITNEY. I think it would be absorbed.

The CHAIRMAN. You think it would all be absorbed?

Doctor WHITNEY. It would all be absorbed.

The CHAIRMAN. There is not any danger, then, of an oversupply?

Doctor WHITNEY. In my judgment there is not. My judgment is that if the normal increase to about 7½ per cent a year had not been interrupted by the war we would now be using from 10,000,000 to 12,000,000 tons.

The CHAIRMAN. There is no doubt, is there, Doctor—and if there is I wish you would tell me frankly—I may be wrong, of course, but I formed the opinion not only from these hearings, but from general reading, that the price of fertilizer is so high that for the ordinary crops it is a very serious question whether the farmer can afford to pay the price he has to pay.

Doctor WHITNEY. Yes; it has been high, but there are reasons for it. There was an embargo on potash. That cut off the great source of German potash during the war, and it took us several years, as you know, to get back. We had none at all to start with. Then the feeding-stock situation increased greatly the cost of the raw materials. While I had charge of the fertilizer law, the Lever law, we had a conference to see if we could force down the price of the organic ammoniates, and we had hearings. We thought they were unreasonably high. We knew the manufacturers were paying as high as $6 a unit, a very high price. The manufacturers said, "Well, what are you going to do? If you want us to bring the price of the organic ammoniates down somewhere near the price of the nitrate of soda or the ammonium sulphate, the feeders will take it all; you will upset the feeding market; you will lower the price of corn, and the price of everything that the farmer raises. What are you going to do; what are you going to give them—cheap fertilizers, or are you going to give them higher prices for their products?" The slaughterhouse men said, "Yes; you can lower prices. Tankage is selling now for $80 a ton. You can put it down to any figure you want to, because we have to figure our profits on the animal, on the meat that we sell."

Senator KENDRICK. That is about what they pay for the meat.

Doctor WHITNEY. Yes. Now, they said, "If you force us to lower the price of this waste product, we will lower the price we pay for the animal or increase the price that we shall charge for the meat." So we were put to it. That was the reason that fertilizers reached such high prices.

Senator HEFLIN. But is it not a fact, Doctor, that if fertilizers were cheaper more farmers would use them?

Doctor WHITNEY. Oh, yes, Senator.

The CHAIRMAN. Well, it has been said here by one of the witnesses that if we had a sufficient supply now and if we operated this plant down there to its capacity, we would make so much fertilizer that it would put all the fertilizer people—and they have money invested in their plants—out of business, and it would throw out of business the Cyanamid Co. over in Canada. Do you know anything about that?

Doctor WHITNEY. Well, Mr. Chairman, when you come to speak of the supply, it has varied greatly with conditions. In 1920 they were preparing for a clean-up, for a banner sale of commercial fertilizers. They got together an enormous amount of material in this country. They got a great quantity of nitrate of soda, and that was thrown on the market. Europe was swamped, the markets of Europe were filled up. Chile had an enormous amount that they had stored up to sell, and the markets of the world were congested. That was a case of real congestion, but it was something that could have been regulated if the conditions had been normal.

Now, the ammonium sulphate market has fluctuated from time to time, partially, possibly, on account of foreign sales. We have sold in one year 225,000 tons of ammonium sulphate, mainly to Japan. In one year we sold Japan large quantities, and they threw it back on the market. That caused a glut, a congestion, and so it varies. This year there have been heavy exports of ammonium sulphate produced in this country, which is a very unusual thing. So there are liable to be little gluts from time to time.

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The CHAIRMAN. I would like to get your opinion, if you care to give it, Doctor, if you have sufficient information upon which you think you can give it, as to whe the operation of this plant down there to its capacity would result in the bankru of the fertilizer people, and would it result in putting the Cyanamid Co. ove Canada out of business, and would it result in making so much fertilizer that market would not absorb it?

Senator KENDRICK. And, Mr. Chairman, I think you ought to include and point there, that the same witness was apprehensive about, and that was the c trous effect which it would have on the by-products of the United States Steel poration.

The CHAIRMAN. The coke ovens?

Senator KENDRICK. That they produced from their coke ovens.

The CHAIRMAN. Yes.

Senator KENDRICK. That it was going to upset that entire industry.

The CHAIRMAN. I confess that I have not been alarmed by those things, becau my lifetime I have seen two processes developed in various ways. I have seen go onto the market and displace others, and the people directly interested were much frightened. Instead of being a detriment it was found that they resulted help to those people. I was in Congress when the printing machines were inst in the Government Printing Office and there was a terrible time here in Washin You will remember it, Doctor.

Doctor WHITNEY. Yes.

The CHAIRMAN. Organized labor was scared to death, and I have no doubt hon so. Men who had been working setting type all their lives thought that they all going to the poorhouse.

Doctor WHITNEY. Yes.

The CHAIRMAN. But they did not do it. They are better off now than they were before.

Doctor WHITNEY. Yes.

The CHAIRMAN. I worked on the farm at $2 a day in the harvest field, and was the only time in the year when we got $2 a day. It was really the only ha we had, and we could work 15 or 20 days and get $2 a day for it. We looked fo to that during the whole of the year. When I was a boy we were hired out to farmer, and usually to the farmer who had the biggest crop of wheat. Along the self-binder. I remember the first one of those that came into our country, lot of fellows got together one night and burned it. I will never forget when I home on Saturday night and my good mother said, "Did you hear about the bu of that binder?" "Yes," I said, "I heard about it. It is an awful thing, is it And she said ,"Yes, that is an awful thing, to burn up a man's binder like t And she thought a while and then she said, "But, after all, what are the poor going to do?" She was a good woman, and yet she was almost willing to fo crime in that case, when she thought it was going to put a lot of those men out of ness; but after the self-binder came along they were all better off than they we fore.

Doctor WHITNEY. Surely.

The CHAIRMAN. And I suppose if this puts anybody out of business, he wil his proper place in the world and finally things will get straightened out.

Doctor WHITNEY. It will be a long while before this plant will be in operati I understand it.

The CHAIRMAN. Well, it will be three years before the dam is finished, und most favorable circumstances.

Senator HEFLIN. I believe you said, Doctor, that you had no faith in the st tion that it would put the fertilizer factories out of business.

Doctor WHITNEY. Oh, no. I think we need fixed nitrogen and we have got to a slight readjustment in our fertilizer practice in order to utilize it.

Senator HEFLIN. What is the difference in the average price of fertilizer for 192 1921?

Doctor WHITNEY. Do you mean the commercial fertilizer?

Senator HEFLIN. Yes; what is the difference in the average price of comm fertilizer for the years 1920 and 1921? The price was considerably lower in 1921, not, than it was in 1920?

Doctor WHITNEY. Yes; in 1921 the market went to pieces.

Senator HEFLIN. Have you got the figures?

Doctor WHITNEY. I have not got them.

Senator HEFLIN. Can you get them?

Doctor WHITNEY. No. You see, the fertilizer control law was repealed by Co in March, 1921, and we dropped out; we dropped all of our contact with it.

Senator HEFLIN. How can we get those statistics?

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Doctor WHITNEY. There were no prices, Senator. They were selling fertilizers at all sorts of prices in 1921.

Senator HEFLIN. In the spring of 1921, when the farmers had already bought their fertilizers, the depression had not come on.

Doctor WHITNEY. That is right.

Senator HEFLIN. But after they got the fertilizers then the depression did come?

Doctor WHITNEY. Then it came.

Senator HEFLIN. Now, in the next year it was of little force and effect.

Doctor WHITNEY. Yes.

Senator HEFLIN. Although the price was very much lower?

Doctor WHITNEY. Yes.

Senator HEFLIN. I would like to get into this record, if I could, the prices in 1920 and also in 1921.

Doctor WHITNEY. I can give it to you for 1920 but not for 1921. The figures that we would give you would mean very little, because the market went to pieces, and they sold at any price.

Senator HEFLIN. Well, you stated there that nearly 8,000,000 tons were used in 1920, I believe?

Doctor WHITNEY. Yes.

Senator HEFLIN. And only a little over 4,000,000——

Doctor WHITNEY. 4,500,000 in 1921.

Senator HEFLIN. In 1921.

Doctor WHITNEY. Yes; the prices were so high and the depression was so great, that we urged the manufacturers to lower their prices to get rid of this high priced stock, but they hung on to it.

Senator HEFLIN. Well, the purchasing power, the debt paying power of the farmer having been so reduced in 1921 was the reason, in your judgment, for the falling off in the use of fertilizers for that year, was it?

Doctor WHITNEY. Oh, yes.

Senator HEFLIN. Now, it was claimed by Mr. Ford's friends that he will produce fertilizers, commercial fertilizer, at about half the price demanded of the farmer at the present time. Do you think that is possible, from the use of the water power at Muscle Shoals?

Doctor WHITNEY. Well, I would not like to say. I have never given any consideration to that.

Senator HEFLIN. That is a little out of your field?

Doctor WHITNEY. That is a little out of my field; yes.

Senator KENDRICK. Well, Doctor, it seems to me that we have in this country a supply of potash, and there is apparently an inexhaustible supply of phosphate.

Doctor WHITNEY. Of phosphates.

Senator KENDRICK. Have you any information as to the supply that is in sight of the nitrates that are secured as they are in Chile and other places?

Doctor WHITNEY. It is very doubtful. That is subject to speculation. We do not know; nobody knows. We do not know whether they will continue very long or not.

The CHAIRMAN. At least, we are absolutely under the control of Chile in that respect?

Doctor WHITNEY. Yes, sir.

The CHAIRMAN. She has been charging an export duty on it.

Doctor WHITNEY. Yes; just as there has been a monopoly in the potash field.

The CHAIRMAN. Yes.

Doctor WHITNEY. In Germany.

The CHAIRMAN. I am not complaining of Chile doing that.

Doctor WHITNEY. No.

The CHAIRMAN. But she has been doing it and she is doing it.

Doctor WHITNEY. Yes.

The CHAIRMAN. Do you know what it is now?

Doctor WHITNEY. What the export duty is now?

The CHAIRMAN. Yes.

Doctor WHITNEY. I do not know.

The CHAIRMAN. Do you know that, Major [addressing Major Burns]?

Doctor WHITNEY. It is, in round numbers, $12 per ton.

The CHAIRMAN. It has been increased from time to time?

Major BURNS. Yes.

The CHAIRMAN. And is liable to be increased at any time?

Major BURNS. Yes.

The CHAIRMAN. Now, Doctor, I would like to ask where the supply of nitrogen comes from that is in the atmosphere? Where does the atmosphere get its supply of nitrogen?

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Doctor WHITNEY. Well, that was here originally.
The CHAIRMAN. We just found that here?
Doctor WHITNEY. Yes.
The CHAIRMAN. If the whole world gets out of nitrogen and goes to taking it
the atmosphere, and if there is no source of supply to replace it——
Doctor WHITNEY. Well, it goes back.
The CHAIRMAN. It does go back?
Doctor WHITNEY. Oh, yes.
The CHAIRMAN. There is not any danger, then, of that supply being corner
Doctor WHITNEY. None in the least; no.
Senator HEFLIN. It is made in the chemical laboratory of the skies, is it, D
Doctor WHITNEY. I presume so.
The CHAIRMAN. Are there any further questions of Doctor Whitney?
Senator HEFLIN. Doctor, how much do we pay to Chile each year for our
supply? Have you got that information?
The CHAIRMAN. I think that is in the record, Senator.
Senator HEFLIN. Is it?
The CHAIRMAN. Did you not put that in the record [addressing Major Burns
Major BURNS. No, sir; we did not.
The CHAIRMAN. All right.
Major BURNS. But some other witness did put it in.
Senator HEFLIN. Something was said about that, but I do not recall that the a
was stated.
Doctor WHITNEY. Our pre-war use of nitrate of soda was about 600,000 tons
used 250,000 tons for agriculture. Those are the figures, as near as we can get at
Senator HEFLIN. About how much would that be in dollars and cents?
Doctor WHITNEY. $50 a ton would probably be a fair average price, would
Major?
Major BURNS. It would be 12 times 600,000, or $7,200,000 a year, roughly, t
pay Chile in export fees. That would be for the 600,000 tons, the entire quanti
Senator HEFLIN. For the 600,000 tons, the entire quantity?
Major BURNS. Yes.
Doctor WHITNEY. Now, for the agriculture, it is about 40 per cent of that?
Major BURNS. About 250,000 tons.
Doctor WHITNEY. Yes.
Major BURNS. About $3,000,000.
Senator HEFLIN. That is for agricultural purposes?
Doctor WHITNEY. Yes.
Major BURNS. Well, for agricultural purposes, you are paying about $3,000,
Chile.
Senator HEFLIN. And about $7,000,000, or a little more, for all produced?
Major BURNS. For all purposes.
Doctor WHITNEY. Yes.
Major BURNS. Fertilizer, as well as the chemical industry.
Senator HEFLIN. Annually?
Doctor WHITNEY. Annually.
Major BURNS. Yes.
Doctor WHITNEY. This looks to me like the opening of a new era. We have t
fixed nitrogen, and it is not altogether adjusted for our present practice. Ou
practices have needed changing anyway, and this is a very good time to ma
change. The length of time it would take to make this change is going to give ev
(who will be involved personally) ample time to make provision for the change
The CHAIRMAN. Some question has been raised about a term used in Mr.
proposition, and maybe you will be able to give us some information on that,
There is some question as to what Mr. Ford, in his so-called guaranty, means w
says that he agrees to operate plant No. 2 at the approximate present annual c
of its machinery and equipment in the production of nitrogen and other fert
said capacity being equal to approximately 110,000 tons of ammonium nitr
annum. Now, what is ammonium nitrate?
Doctor WHITNEY. Ammonium nitrate is this ammonium gas that is produce
cyanamid. A part of this is oxidized to nitric acid, and nitric acid absorbs an
of ammonia, making ammonium nitrate. Shall I go ahead on that?
The CHAIRMAN. Yes; go ahead.
Doctor WHITNEY. The capacity of that plant is measured by 40,000 tons o
gen. That is the measure of it.
The CHAIRMAN. Then, 40,000 tons of nitrogen is equal to 110,000 tons
monium nitrate?

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Doctor WHITNEY. Yes; or 190,000 tons of ammonium sulphate, you see.

The CHAIRMAN. In getting this product here that he mentioned, would you get this before you got the 40,000 tons, or would you get that first, and get this afterwards, in your process?

Doctor WHITNEY. Well, I do not know what he means, but I believe that he means that he would make fertilizers on the basis of 40,000 tons of nitrogen or 110,000 tons of ammonium nitrate.

The CHAIRMAN. Is there a difference between those two terms?

Doctor WHITNEY. No; they are equivalent.

The CHAIRMAN. I know they are equivalent.

Doctor WHITNEY. They are equivalent.

The CHAIRMAN. But some doubt was thrown on it and I wanted to find out whether, if this was complied with here, and 110,000 tons of ammonium nitrate were made, from there on what would be necessary to be done in order to convert it into fertilizer. Would that be an expensive process?

Doctor WHITNEY. No; that is one of the constitutents here. Now, if he used one of these formulas—I do not know what his methods are going to be at all, but the amount of material that he could make of any one of these would be limited by the amount of nitrogen.

The CHAIRMAN. Exactly.

Doctor WHITNEY. Yes.

The CHAIRMAN. Which is the more expensive, 40,000 tons of nitrogen or 110,000 tons of ammonium nitrate?

Doctor WHITNEY. Well, the 110,000 tons of ammonium nitrate would be more expensive than this, because it has involved a process of oxidation.

The CHAIRMAN. In making the ammonium nitrate mentioned, do you first get nitrate?

Doctor WHITNEY. You first get ammonia.

The CHAIRMAN. What I am trying to find out is, is the 40,000 tons the result of something done with the 110,000 tons?

Doctor WHITNEY. No.

The CHAIRMAN. Well, is the 110,000 tons the result of something done with the 40,000 tons?

Doctor WHITNEY. You get that first.

The CHAIRMAN. You get that first?

Doctor WHITNEY. That is the measure of the capacity of your plant. Now, the 40,000 tons of nitrogen can be converted by processes which involve expense into 110,000 tons of ammonium nitrate.

The CHAIRMAN. When you get that 110,000 tons of ammonium nitrate, what is left to be done, in order to get it ready to mix up the fertilizer?

Doctor WHITNEY. Now, what does he say in his proposition?

The CHAIRMAN. Yes; you may take that up [handing Mr. Ford's proposition to the witness].

Mr. WHITNEY. He says——

The CHAIRMAN. It commences right there [indicating].

Doctor WHITNEY. "The company agrees to operate nitrate plant No. 2, using the most economical source of power, at the approximate present annual capacity of its machinery and equipment in the production of nitrogen and other commercial fertilizers (said capacity being equal to approximately 110,000 tons of ammonium nitrate per annum)."

I do not know what it means—I have not talked with him at all, but I take it that when you use this as a standard and when he says that he will make commercial fertilizers complete, up to the limit of the capacity of the plant, which is 40,000 tons of nitrogen, he is promising to deliver to you complete fertilizers, the quantity of which is based upon the amount of nitrogen, the capacity of the plant to produce nitrogen.

The CHAIRMAN. Well, Doctor, would there be any difference in this paragraph if, instead of using this clause which is in parenthesis, as follows:

"(said capacity being equal to approximately 110,000 tons of ammonium nitrate per annum)"—

He used this language, "said capacity being equal to approximately 40,000 tons of nitrogen per annum"?

Doctor WHITNEY. I do not think that that would make any difference.

The CHAIRMAN. It means the same thing?

Doctor WHITNEY. It means the same thing.

The CHAIRMAN. Yes.

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Doctor WHITNEY. The question is whether he is pledging himself to make fertilizers up to the capacity of 40,000 tons of nitrogen, which the plant has. in connection with this I understood from a statement of Mr. Mayo before the Committee on Military Affairs, page 977 of hearings, that the total amount of ferilizers that he contemplates making under that provision is, according to its fo 2,000,000 tons of completed 2–8–2 fertilizer.

The CHAIRMAN. Is that right?

Doctor WHITNEY. Yes.

The CHAIRMAN. With 40,000 tons of nitrogen, about how many tons of comm fertilizer could you make?

Doctor WHITNEY. Well, that depends upon your formula. Now, he gave th Mayo, gave it in his statement, and, according to the ratio of nitrogen to th constituents, in 2–8–2 it is 2,000,000 tons that would be made out of this 40,0 of nitrogen.

The CHAIRMAN. I see; yes.

Doctor WHITNEY. Yes.

The CHAIRMAN. Doctor, I think that is all that we wanted to ask you, unle have something further that you wish to state.

Doctor WHITNEY. No; I think not.

The CHAIRMAN. We will adjourn here until 2 o'clock.

(At 12.40 o'clock p. m. the hearing was adjourned to 10.30 o'clock a. m., M May 8, 1922.)

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MUSCLE SHOALS.

MONDAY MAY 8, 1922.

UNITED STATES SENATE,
COMMITTEE ON AGRICULTURE AND FORESTRY,
Washington, D. C.

The committee met, pursuant to adjournment, at 10.30 o'clock a. m., in the hearing room of the Committee on Commerce, United States Senate, Capitol Building, Senator George W. Norris presiding.

Present: Senators Norris (chairman), Keys, Gooding, Norbeck, Kendrick, Harrison and Heflin.

The CHAIRMAN. The committee will come to order.

STATEMENT OF DR. CHARLES L. PARSONS, CONSULTING CHEMIST, WASHINGTON, D. C.

The CHAIRMAN. Doctor Parsons, we have been considering for some time the various bids that have been made for this Muscle Shoals project by private parties. We would like to hear you this morning on your bid. First tell the committee just who you are and something about yourself, so the record will show.

Doctor PARSONS. It depends somewhat on what you desire. I did not understand I was called here this morning with reference to the bid I had made. Your letter stated that you wanted me to come and testify as a chemist, as I have before some of the other committees.

The CHAIRMAN. We will be glad to have you do both.

Doctor PARSONS. In the first place, may I give a statement in a brief way as to what my experience has been along these lines. So far as the bid itself is concerned, that is quite a different matter.

The CHAIRMAN. Yes, sir.

Doctor PARSONS. I first came in touch seriously with the nitrogen situation when, in 1916, I was selected by the War Department to go abroad and study the situation for them as their chief chemical engineer, being at that time chief chemist of the Bureau of Mines, and transferred to the War Department for that purpose.

I went abroad and visited various plants, consulted with the nitrogen experts of England, France, Italy, Norway, and Sweden, and returned to this country in December, 1916, and made my report to General Crozier. The report which I made did not agree entirely with a report which had been made by a committee of the National Academy, and they appointed a second committee to coordinate the two reports, and that committee essentially adopted mine, practically unanimously. It consisted of a larger portion of the members of the National Academy Committee, of Doctor Hilebrand of the Bureau of Standards, who had been added thereto, Admiral Earl, General Crozier, General Wheeler, and myself. They came to their final conclusion in May, 1917, and made a report with reference to the installation of what was afterwards plant No. 1, making the recommendation that it be located in southwest Virginia or contiguous territory, behind the mountains.

I was afterwards called into the Ordnance Department's first conference when later the emergency arose which necessitated the rapid increase in plants for the fixation of nitrogen. I was at their first meeting, in October, 1918, and differed from everyone else there with reference to the crying necessity for the building of plant No. 2: put my opinion on record in writing the next day with General Crozier and had nothing to do with plant No. 2 thereafter.

I was, however, a member of the nitrate commission established by the War Department, consisting of Admiral Earl, W. R. Whitney, A. A. Noyes, Gano Dunn, and E. E. Summers, to whom the chief technical questions were referred thereafter whenever they felt there was a necessity for further action. For example, the question of where plants Nos. 3 and 4 should be located and the processes which plants

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Nos. 3 and 4 should use was referred to us when the War Industries Board concluded that further plants were necessary. At that time I, with the others, voted for the building of those plants for operation by the cyanamid process, although we did not select the sites which were afterwards chosen. The vote for the cyanamid process at that time was based solely on the question of availability and ability to put the plant in rapidly with certainty of a product. It was definitely stated in that vote that this was done without reference to cost, it being conceded that the cost would be greater than by some other and more modern processes.

Since the war I was for about a year—a little over a year; in fact a year and five or six months—connected with the Atmospheric Nitrogen Corporation in a consulting capacity. This corporation built a very successful plant at Syracuse, working by a modified Haber process, the same process as was installed in plant No. 1 at Muscle Shoals. That plant functioned from the first minute it started and has run steadily from last August up to the present time with an output of something like 20 per cent or 25 per cent in excess of its rated capacity, and is running to-day very successfully at Syracuse.

My connection with the Atmospheric Nitrogen Corporation——

The CHAIRMAN. What is its capacity?

Doctor PARSONS. It was a 10-ton plant, and it is turning out over 12 tons of ammonia every day.

My connection with them ceased shortly after the plant was in operation.

The CHAIRMAN. That is a privately owned plant?

Doctor PARSONS. That is a privately owned plant; yes, sir.

The CHAIRMAN. The Government had nothing to do with that?

Doctor PARSONS. The Government had nothing to do with that plant, but there was no question whatever but that it was able to run successfully from the start on account of the experience which was gained in the first operation of plant No. 1 at Muscle Shoals. That is the only important relation between the two. It is built by essentially the same process, with a change in the catalyst and a strengthening and alterations of the machinery, and is functioning very successfully to-day.

Major Burns has been through it and has undoubtedly already spoken to you regarding the operations of that plant at Syracuse. My connection with it ceased last August and at the present time I have no connection with anyone interested in developing plants for the fixation of nitrogen. I am now simply a consulting chemist, and I am here absolutely as a free lance, to give you my testimony.

The CHAIRMAN. I think, Doctor, you had better state for the record a little more of your own personal history. How old are you, first?

Doctor PARSONS. I am 55 years old.

The CHAIRMAN. Tell the committee about your business, where you were educated, and what you have been doing.

Doctor PARSONS. I am a graduate of Cornell University. I have honorary degrees from the University of Maine and the University of Pittsburgh. I was professor of chemistry in the New Hampshire College until 1911, when I came here as chief chemist of the Bureau of Mines. I was with the Bureau of Mines from 1911 until November 1, 1919, as their chief chemist, and chief of the Division of Mineral Technology. I had full charge of the radium work—of which you have undoubtedly heard much—of the Bureau of Mines, getting about a million dollars' worth of radium for a net cost of $350,000. I had full charge of the building of the cyanide plant at Saltville during the war, in order to produce sodium cyanide for the production of poisonous gases, having $2,800,000 put aside for the building of that plant by the War Department, and having practically full charge of it, with 350 officers and men reporting to me in connection with that plant.

That plant functioned from the first, and you have never heard anything about it in any of your hearings, but what it was absolutely all right. It was never questioned and had absolutely a clean bill of health from the board that examined it. The plant was a success from the day it began operation.

The CHAIRMAN. Doctor, we have learned from our experts that nitrate plant No. 1 at Muscle Shoals, the small plant using the Haber process, has been a failure so far as the production of nitrogen is concerned. Tell us about that.

Doctor PARSONS. I rather deplored the general idea around that plant No. 1 has been a failure. I do not consider it so at all. It is true that plant No. 1 never produced any considerable amount of ammonia, but it would have done so, and would have done so successfully, had it been somewhat remodeled. That has been definitely proved by the fact that this plant at Syracuse, which is simply an outgrowth of that, is the only successful plant for the fixation of nitrogen in America to-day, and is in entire accord with the plants in Europe which are operating along the same lines. These are the only successful plants in the world to-day for the fixation of nitrogen where their investment has not been written off by war profits.

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Plant No. 1 at Muscle Shoals is operated by what is known most correctly as the synthetic ammonia process, first known as the Haber process, which has three modifications now successfully operating. One of those, the Haber process per se, is operating in Germany to the extent of 300,000 tons of fixed nitrogen per year, which is equivalent to over 1,500,000 tons of ammonium sulphate; two plants in Germany operating by that process giving that total amount. That plant operates at pressures between 100 and 300 atmospheres; that is, the patents cover those pressures. They are actually running at about 200 atmospheres pressure, which is about 3,000 pounds per square inch.

The Claude process, developed in France, is using exactly the same chemical reaction, but it has escaped some of the elaborate apparatus by developing better mechanical devices and operating at very high pressure. It actually operated at 900 atmospheres pressure, which is 13,500 pounds per square inch. Their patents cover the right to operate between 300 atmospheres and 2,000 atmospheres, but when I last saw it, it was operating at pressures around 900 atmospheres.

The CHAIRMAN. Where is that located?

Doctor PARSONS. That is at Monteraux, about 40 miles outside of Paris.

The CHAIRMAN. Was that built during the war?

Doctor PARSONS. No, sir. It was built since.

The CHAIRMAN. What is its capacity?

Doctor PARSONS. It is only a small plant. I think the average capacity is about 5 tons a day. The great difficulty which they are having in France, which is a difficulty which I will lead up to shortly with the Haber process, is their inability to get hydrogen pure and cheaply. Otherwise the plant is running very smoothly. I have never been in a plant that was running more smoothly and easily than that plant. I was profoundly impressed with the very small number of workmen they have in the plant. There were only three or four in it, and they were sitting around in chairs reading newspapers just exactly as men would do in electric-light stations. The machinery was turning perfectly smoothly. They once in a while got up and went to look at gauges, but that was apparently all they had to do. That impressed me a great deal. The ammonia was turned out as liquid ammonia rapidly. I saw them taking it out in cylinders frequently while I was there.

Then there is a third process, known as the General Chemical Co. process, whose patents cover lower pressures from 100 atmospheres down. They operate a little under 100 atmospheres. It was that process which was the only one of the Haber processes of which we could have knowledge and which they had operated only in a small experimental plant, giving out a few pounds of ammonia per day. That was the only knowledge that we had to go on when we first decided to make a trial of that process in plant No. 1, which was to have gone to North Chattanooga as we supposed.

The CHAIRMAN. And which did, in fact, go to Muscle Shoals?

Doctor PARSONS. It went to Muscle Shoals by the President's order against the advice of every technical board that had anything to do with the situation.

The CHAIRMAN. Perhaps it would be well to explain that point. Why was it desirable to go to this place in North Chattanooga in preference to Muscle Shoals?

Doctor PARSONS. If you will allow me to finish this other I will come to that in a moment.

The CHAIRMAN. All right; go ahead.

Doctor PARSONS. The plant at Muscle Shoals was advisedly a trial operation. The Germans in starting their first Haber plant had built and destroyed and built again a number of times. When the war came on they were just ready to go ahead with the Haber process, having got it up to a point where they were producing some 6,000 tons of ammonia per year by the plant which they had. They had been working on it for years. I saw the first experimental work, shown in this country, in New York, in 1912, at the International Congress of Pure and Applied Chemistry. It was then considered a very great advance in chemistry. It was two or three years after that before they got any production, and they had been then working on it for a considerable number of years.

The fact that within a year we were able to construct at Muscle Shoals this unit—only about a 10-ton unit, if I remember correctly—at plant No. 1, although it was intended to be increased to a 30-ton unit, and found that we got all of the information which was necessary to reconstruct the plant and build an absolutely successful plant does not indicate to me that plant No. 1 was a failure but shows to me very plainly that it was about as successful a trial experiment as one could hope to make in such an immense undertaking. That was the purpose for which the committee originally advised the building of the plant.

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Now, to come to your question as to why the board advised North Chattanooga
It was very carefully considered, and the first and basic consideration was a
sideration which is just as applicable to-day and which is at the basis of all o
publicity and propaganda, namely, that power has very little relation to the que
of cheap fertilizer production; therefore it was not considered necessary in any w
append plant No. 1 to any power site. It was deemed advisable, firstly, to p
behind the mountains, where in case of attack it would be relatively free from fo
invasion, and, secondly, it was desired to get it very close to the coal mines and t
possibility of sulphuric-acid production. We looked for supplies of pyrite and
plies of coal. We thought at first it should go down into southwestern Virginia
several trips were made through that country in an attempt to find a site for it, b
were unable to find sufficient level ground for a plant of this proposed develop
and the powder plant which the Ordnance Department wanted to go with it in
The only site that could be found was down farther south. They finally decided
and recommended North Chattanooga, Tenn., which was behind the mountains, w
was well defended, which was right at the end of a railroad which could bring sulp
acid from Copper Hill, the largest suplhuric-acid plant in the world, and was cl
large deposits of coal. That was the basic reason for having the plant go to
Chattanooga. That was the reason why all three of the Secretaries making the
departmental committee that was supposed to decide the location of the plant
unanimously for North Chattanooga as the site. As I happened to be present a
final meeting representing Secretary Lane, who was called out of town and whc
me his written vote to carry over and instructions to give his reasons for it, I am
sure of my facts.

The CHAIRMAN. Now, why was it decided that it should be placed at Muscle S
instead of North Chattanooga? What was the argument for that?

Doctor PARSONS. Why, I think you will have to go back to Mr. Graham's he
on war expenditures. It was sent to Muscle Shoals by the President's order.
is all we know.

Senator KENDRICK. Is it not likely that it was sent there on account of the
that was expected to be derived from that dam?

Doctor PARSONS. Every board had passed on the fact that power was not nece

Senator KENDRICK. Well, but we have heard nothing else since we bega
investigation but the fact that the cyanamid plant could not be operated on
power; that it would take cheaper power to operate.

Doctor PARSONS. We have heard nothing else; that is quite true, Senator.

The CHAIRMAN. I think it ought to be said that we have not heard, or at l
have had the idea from the beginning from our experts, that in the Haber proce
called, power was just an incident of no particular importance.

Doctor PARSONS. Just about as much importance as it would be in the orc
factory?

Senator KENDRICK. I know, but the whole contention has been that that p
was a failure; that is, that the plant we had at Muscle Shoals was a failure, and th
were going to depend upon the cyanamid plant to get our materials.

The CHAIRMAN. Yes, of course; but if, as a matter of fact, power is not at all
sary in the Haber process, that would be no argument to put it at Muscle Shoals
as I can see, and I did not suppose that was the argument. I never knew w
went to Muscle Shoals.

Doctor PARSONS. You will find a good deal about that in Mr. Graham's testi
You will find in the House testimony facts and statements of how those things
about and how everybody was surprised, and how General Crozier wrote acro
bottom, "Ordered to Muscle Shoals by the President," and that is all we know
it. We do not know that there had been great demands to have Muscle Shoa
veloped for three or four years before, and, as I mentioned a moment ago—and
not dwell on that too strongly, and I hope Senator Kendrick will get this clea
mind—the relation between power and cheap fertilizer is a mere shibboleth.
interested in the power, and especially land speculators, have painted a bea
mirage for the farmer, which will fade utterly on approach.

The CHAIRMAN. Doctor, that is not true, is it, in regard to the cyanamid proc

Doctor PARSONS. The cyanamid process is in a state of obsolescence. The
in France, in Italy, in Dalmatia, in Silesia, in Norway, in Sweden are closed
The plant in Canada is not producing cyanamid for fertilizer purposes, but in
quantity for the manufacture of urea, which is used in this celluloid material
goes into automobile windows, and in producing sodium cyanide, from which is
hydrocyanic acid, for killing insects on citrus trees in the West. The plant is ru
only on a very small output. In the main the cyanamid process is essentially a
obsolescent.

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Senator KENDRICK. That is all very true, Mr. Chairman, and I am ready to concede that, but the question has been asked here as to why the plant went to Muscle Shoals. Now, my brief trip down there in that country convinces me that it was in view of the fact that at that particular time we were depending upon the cyanamid process, and the further fact that we agree that it did cut an immense figure—that is, that the power did cut a big figure in the production of nitrates in the cyanamid process.

The CHAIRMAN. Yes; Senator, that is true; but that does not apply to the Haber process.

Senator KENDRICK. If I had gone down and looked at it myself with no information whatever as an engineer, I would have put it at Muscle Shoals on that basis. I never dreamed that there was a place in the country—that is, in the eastern part of the country, where it was possible to develop the power that can be developed at Muscle Shoals with water.

The CHAIRMAN. I think we all agree with that, Senator, and we all agree also that it was necessary in the cyanamid process that that be located at a great power site and that is why plant No. 2 was located there, very properly. But I do not see that it has any application whatever to plant No. 1.

Senator NORBECK. May I ask one question, Mr. Chairman, as to this power? I wish, if it is possible to have these figures in the record, to know what per cent of the cost would be power.

Doctor PARSONS. I can give you that, and then I think I can clear up this other point also.

Senator NORBECK. Would you do that and hand it to the clerk?

Doctor PARSONS. It will take me just a moment.

(A short recess was here taken to enable the members to answer roll call in the Senate.)

Senator NORBECK. Senator Heflin, Senator Kendrick has suggested here the question of trying to determine the relative importance of power in the manufacture of fertilizer under the different processes, and I am just calling your attention to that because I know it is something you are vitally interested in.

Doctor PARSONS. First, if you will allow me, before I come to your question, I will take up the point which Senator Kendrick made, and that is with reference to this plant going to Muscle Shoals. You understand that plant No. 1 was decided upon many months before there was any real emergency. Plant No. 1 was decided upon with the idea of filling the needs of the national defense act, to give both a supply of nitrogen for explosives and a supply for fertilizer purposes. Therefore, with that plant, as power was not at all important, there was no question of putting it at a power site. When plant No. 2 afterwards was decided upon some nine months later a very different condition of things had arisen. At that time we were very greatly pressed by the German submarines, and there was a distinct fear that we would be cut off from the Chilean nitrate fields, therefore it was necessary to put in as a measure for war purposes solely plant No. 2.

Senator KENDRICK. I want to substantiate that statement because of a personal experience. The most gloomy time that ever I saw during the war was when the members of the Military Affairs Committee told me that there was a very good chance for us to be cut off from Chilean nitrates.

Doctor PARSONS. Plant No. 2 was put at Muscle Shoals basically because plant No. 1 had been already ordered there by the President. Even at that time there was perfect knowledge that there would be no power available for plant No. 2 at Muscle Shoals until after the war was over, for it was estimated it would take from five to six years to complete the dam. That is why they put in plant No. 2, which was solely a war plant and was never expected to serve for fertilizer production, and fertilizer production was not mentioned at the conference in the Ordnance Department that night, at which I was present. They put it at Muscle Shoals and then built the steam plant and arranged with the Alabama Power Co. for the transmission of power from the Warrior River, 80 miles away, so that plant No. 2 could be quickly operated. So, you see, there is very little connection between fertilizers and this plant in any way. I can not see how they are connected at plant No. 2, because at plant No. 2 they have all the power that is needed from the steam plant, and it has had all the power it needs from the steam plant for its operation since plant No. 2 was finished. They were built at Muscle Shoals probably with the idea of having them built there so Muscle Shoals would ultimately be developed.

But the basic point which I want to bring out strongly in my testimony, which I am anxious you all should get, which can be demonstrated, and which has been acknowledged, I think, by every board which has passed on the matter, is that cheap fertilizer and cheap power are not closely related.

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Senator KENDRICK. I am glad to hear you say that, Doctor, because that is the first intimation or mention of anything of that kind that this committee has h

Doctor PARSONS. Now, as to these processes. The Haber process requires 0.25 to 0.3 of a horsepower year per ton of nitrogen. The cyanamid process——

Senator NORBECK. Not per daily ton? That is per year?

Doctor PARSONS. No; per year.

The cyanamid process requires approximately 10 times that amount, or two and half horsepower years per ton of nitrogen fixed.

The arc process, which is developed in Norway, requires 10½ horsepower yea ton of nitrogen fixed. It is due to the fact that those immense Norwegian p (which were the first ones to be built, and which were built for the manufact nitric acid to be made into calcium nitrate for fertilizer purposes) require such imm power that there is the public idea to-day that power and cheap fertilizers are nected. But those plants in Norway to-day would, if it were not for the Haber pa stop using that power in the way they do and use it through another method.

Senator NORBECK. And that would possibly mean the relocation of the plan other places than near water power?

Doctor PARSONS. Not necessarily. I will later show you where water power be used with the Haber process. According to one of the engineers connected wit plant, if it was not for the Haber patents their inability to use them (which w use) in Norway they would probably abandon their present method and woul that power, which is very cheap power (less than $5 per horsepower year) for electr ing water to give them the hydrogen which is necessary for the production of amm through the Haber process.

The basic raw materials used in the Haber process are nitrogen and hydrogen. nitrogen can be obtained cheaply and easily in the uncombined form from air th liquefying plants at a cost of approximately 10 cents per thousand cubic feet, so it does not come seriously into the cost situation. The hydrogen, on the other h is the basic and most expensive constituent of ammonia, and it is the most cos procure. It can be procured in two ways. One is from coal and water, as it is duced in Germany, as it is produced in Syracuse, and as they will produce it at Bi ham, England, where there is a hundred-ton plant being erected. These p operate by simply passing water over red hot coal to make water gas, then pa that water gas mixed with a little steam at proper temperatures over a mixture o oxide and chromium oxide, thus getting a secondary reaction to take place w gives you hydrogen, carbonic-acid gas, and carbonous-acid gas. The carbonic gas can easily be removed from the hydrogen, but the carbonous-acid gas can n so easily removed. The removal of carbonous-acid gas, or carbon monoxide, w is poison to the catalyst, is the most expensive part of that procedure Seco you can pass an electric current, which, of course, must be produced by power, thr water and electrolize that water into two gases—hydrogen and oxygen. Now can afford to use water power to produce hydrogen by that method, where you get water power for around $10 per horsepower year or less, but with power a above this price you are forced to make your hydrogen from coal and no one has hoped to produce the primary power for this cost price at Muscle Shoals. Co Cooper places the price of the secondary power at 1.2 mills per kilowatt hour.

Senator NORBECK. What does that make per kilowatt hour?

Mr. LEVERING. A trifle over a mill.

Senator NORBECK. That would be your answer, a trifle over a mill?

Doctor PARSONS. Yes; $10 per horsepower year is a trifle over a mill per kilo hour.

Senator NORBECK. Assuming that the product is a certain price per ton now— are familiar with the market—and the best method of manufacturing it by the c amid process was used, what would be the difference in the cost of the product bet one mill horsepower, say, and ten mills horsepower?

Doctor PARSONS. By the Haber process?

Senator NORBECK. Well, I want to get both processes.

Doctor PARSONS. By the Haber process it would be absolutely impossible to u at the latter figure. It would put the cost of hydrogen up so high that it could n considered, because there the power is a very great factor, if you are going t that method.

Senator NORBECK. I understood you to say that in Norway they had in mind power in connection with the Haber process.

Doctor PARSONS. They have in mind using that power for the electrolysis of w which I have explained, if they could get around the Haber patents.

Senator NORBECK. If we can get around the Haber patents, then our water p at Muscle Shoals or anywhere else would be a cheapening factor in the manufa f fertilizer under the Haber process? Is that the answer?

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Doctor PARSONS. No; it would have to be much cheaper than you have it. As I say, if your water power is a mill per kilowatt hour or $10 per horsepower year, you can use it. With any power less than that you can afford to make your hydrogen by that method, and use the Haber process. If you have to pay much more than that for your power you would make your hydrogen by coal, because it would be cheaper to do it.

Senator NORBECK. We have two processes before us that we are really talking about, because we have two plants, one built to manufacture under the one and the other under the other. The point I am very anxious to get in terms that I can understand is how much could we cheapen the fertilizer by either process by free power, or from commercial power, say, costing a cent per kilowatt?

Doctor PARSONS. That is a pretty broad and extensive subject.

Senator NORBECK. Is it a dollar a ton or $20 a ton? Some men think here that fertilizer could be produced and the price reduced one-half by cheap power. If so, we want to know it.

Doctor PARSONS. I understand that Mr. Mayo stated that Mr. Ford is going to make 2,000,000 tons of 2–8–2 fertilizer per year and reduce its price to one-half or even to one-third. You could put all the nitrate that you could manufacture in plant No. 2 into that amount of fertilizer for nothing and it would not reduce the cost one-third.

Senator HEFLIN. That is rather a strange situation. I got the impression from what he said, Senator, that he could pay $100 a horsepower or $5 a horsepower, and it would not make any difference if he manufactured fertilizer; one will do it just as cheaply as the other, paying $100 or $5.

The CHAIRMAN. Oh, I did not get that idea.

Doctor PARSONS. Not at all, Senator. What I am saying is this. I am talking about the Haber process only.

Senator HEFLIN. The impression made on my mind was that the price of horsepower did not have anything to do with it. Whether he uses high horsepower to produce the fertilizer or low horsepower, he could sell it at the same price?

Doctor PARSONS. The amount of power which is necessary to operate by the Haber process is approximately three-tenths of a horsepower year per ton of nitrogen fixed. That is all that is really required. The question is to get cheap hydrogen, which is the basic raw material used in the Haber process. Now, if you happen to have power that is less than $10 per horsepower year you can probably obtain that hydrogen cheaper than you can from coal, but you would not wish to pay more than $10 per horsepower year, because at that price you can make your hydrogen by an entirely different method requiring no power from coal, so that your hydrogen, which is the basic material, can be made with or without power. You can not afford to pay more than that, because you can get it without the horsepower at all.

Senator NORBECK. Will you pardon me if I ask this question over once more at least, to get it clear in my mind.

Suppose the Government furnished free power for the manufacture of fertilizer under the cyanamid process; would it reduce the cost of fertilizer $1 a ton or $10 a ton or $20 a ton?

Doctor PARSONS. Why, that has been brought out in the hearings. I think Major Burns said——

Senator NORBECK. It has been touched upon, but we would like to have your opinion on it.

Doctor PARSONS. My opinion is if you gave the power for nothing and paid a bonus on top of it of pretty nearly the price that you are counting on for your power down there, say $10 per horsepower year, you can not fix the nitrogen by the cyanamid process in competition with the Haber process without sensible power requirements.

Senator NORBECK. Admit all that. That does not answer my question.

Doctor PARSONS. I am trying to answer it.

Senator NORBECK. I am trying to find out what per cent of the cost per ton is power under the cyanamid process.

Doctor PARSONS. I should have to do some figuring before I could tell you.

Senator NORBECK. Would you be willing to put that in the record?

Doctor PARSONS. Yes, sir. I can not tell you offhand.

(The statement requested was subsequently submitted by Doctor Parsons and is here printed in full as follows:)

"It requires approximately 3,000 kilowatt hours to make 1 ton of ammonium sulphate by the cyanamid process. Therefore, at 1 mill per kilowatt hour the cost for power per ton of ammonium sulphate would be $3, or at 4 mills $12. If the power, therefore, cost nothing it would reduce the cost of ammonium sulphate $3 in the first case or $12 in the second. As a commercial fertilizer of 2–8–2 grade contains only 10 per cent of ammonium sulphate, the difference between charging 1 mill per kilowatt hour or furnishing the power free would make a difference in cost of the mixed commercial fertilize of only 30 c nts."

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Senator KENDRICK. It is a great deal more than the price that enters into t
of production under the Haber process.

Doctor PARSONS. I think that condition is shown abroad clearly in the cy
plant which has just been scrapped at Odda, Norway. That plant is from on
to one-half the size of the plant at Muscle Shoals. It is a modern, up-to-date cy
plant, the best cyanamid plant I have ever been in with the exception of
Muscle Shoals. It is a first-class cyanamid plant. Their power was costing
$7.20 per horsepower year, as I understand.

The CHAIRMAN. That would be less than a mill per kilowatt hour, would it

Doctor PARSONS. Yes.

Senator NORBECK. They found they could not make it?

Doctor PARSONS. They sold that plant on the 11th of last February, a plant
cost several million dollars, under bankruptcy proceedings for $10,000, or
kroner.

Senator NORBECK. It was not a Government-owned plant?

Doctor PARSONS. It was a privately owned plant. They simply could n
tinue the production in competition with the Haber process on the other side.
sold most of their ammonia to the big plants at Rjukan, who wanted to ma
monium nitrate. The ammonia from the plant at Odda, which was compa
near by could not compete with the Germans. The Germans were able to la
from the Haber plant in Merseburg in 40-ton tank cars, liquid ammonia be
price that these people coud make it in Norway, even on the basis of that ve
priced horsepower. They closed and sold the plant in order to pay the powe
pany's bills, and are hoping that they can make arrangements to use that
which is less than 1 mill per kilowatt hour to produce hydrogen electrolytical
put in a Haber plant in Norway.

The CHAIRMAN. Doctor, as I understand you, your opinion is that our pl
2, the cyanamid plant, is of no value whatever except as a war proposition?

Doctor PARSONS. Quite right. Well, I would like to modify that just s
I don't wish to say it is of no value whatever, because it is quite possible t
furnaces might be used to a limited extent for the production of calcium carb
acetylene, for which there is a certain limited market in the South. Of co
have rather large plants up here along the Canadian line for making that m
It is possible, also, that those same furnaces might be utilized for the electro
production of phosphoric acid, but that is still a problematical question. Th
three plants now built for the production of phosphoric acid electrothermal
two of them are operating and—the third although recently finished by the A
Cyanamid Co. is not operating. They manufacture phosphoric acid not for f
purposes, because they have not manufactured it cheaply enough, but to be
baking powders and in soft drinks for soda fountains and the like. They are
a pure high grade phosphoric acid which brings a much higher price.

The CHAIRMAN. Let me put my question again in a little modified form.
Is it your judgment plant No. 2 at Muscle Shoals is of no value whatever
tilizer proposition?

Doctor PARSONS. Plant No. 2 at Muscle Shoals, in my opinion, is of no valu
soever as a proposition for the fixation of nitrogen. I am not prepared to st
nitely that some of the furnaces there might not be made, with cheap enoug
to turn out some phosphoric acid.

The CHAIRMAN. That would be another ingredient of a fertilizer?

Doctor PARSONS. Yes; that would be another ingredient of fertilizer; but
entirely problematical. I doubt if anybody knows. It never has been done.

The CHAIRMAN. The machinery would not have to be changed to do that w

Doctor PARSONS. The electric furnaces which are there could be used in ess
the same form, but it would take a very small part of the plant, you know.

Senator NOBECK. What per cent of the value would be the electric furnace?
it be 1 per cent, or would it be much less or much more?

Doctor PARSONS. Of course the question of cheap power in the proble
method of procedure is a very important factor, and the furnace is simply
out of fire brick.

Senator NORBECK. The cost of the furnace is a very tiny part of the cos
plant, is it?

Doctor PARSONS. Of the whole plant?

Senator NORBECK. Yes.

Doctor PARSONS. Comparatively a small part, still it is rather costly to bu
electric furnaces.

Senator NORBECK. Is the furnace worth a million dollars?

Doctor PARSONS. Oh, no.

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Senator NORBECK. Is it worth $100,000?

Doctor PARSONS. No. It is just a matter of a few thousand dollars.

Senator NORBECK. It is a very small percentage of the value of the plant.

Doctor PARSONS. Yes, sir.

Senator NORBECK. And that might be made use of?

Doctor PARSONS. That may be used; yes. Mr. Swann proposed that, and I have no exception to take to his statement except, like many other statements, they are simply what he hopes he can do. The Bureau of Soils has been working at phosphoric acid for five or six years. Phosphoric acid has not been, up to the present time, produced cheap enough by the electric furnace method to be sold and put on the market in competition with commercial fertilizer.

The CHAIRMAN. Now, as I understand you, going again to the Haber process as it now used and operated, for instance, at Syracuse, N. Y., the question of power is so small an item that it is not worthy of consideration, but there might be a modification of that method where power might be used very properly, if it was cheap enough, in securing the necessary hydrogen?

Doctor PARSONS. Yes; but there I want you to understand that that must be a very cheap power. I don't believe it is going to be possible——

The CHAIRMAN. That is, cheaper than we have at Muscle Shoals?

Doctor PARSONS. All except your secondary power; yes. The first 100,000 secondary power might, in my opinion, be utilized well for the operation of a Haber plant erected on the site of plant No. 1, and it is on that account that I made this offer. The offer which I made is based solely on the contingency that the Government comes to the conclusion that it will either accept the Alabama Power Co.'s, offer and will have this 100,000 horsepower available as secondary power or that the Government itself builds the dam and has that 100,000 of secondary power available for sale.

In my opinion there is no other water power at Muscle Shoals which can be economically and properly used in the production of fertilizers, either by phosphoric-acid method or by the Haber method or by any method known to-day.

The CHAIRMAN. Your offer is not to be considered, then, if the committee decides to accept the offer of Mr. Ford or of Mr. Engstrum?

Doctor PARSONS. It has no bearing on it whatever.

The CHAIRMAN. I think, Doctor, you had better put your offer in the record. You have not done that yet.

Doctor PARSONS. I would like to take only a moment to read this offer to you, with possibly questions on it, so that you can get a clear understanding of it.

The CHAIRMAN. All right.

Doctor PARSONS. I have tried to make it a straight out business proposition and nothing else, and I am willing to explain anything in connection with it, but I want to say frankly that I do not see that there is any possibility that the basic condition is going to immediately arise by which there is any possibility of your accepting this offer, so therefore I have made no attempt to press it. It is simply a proposition that if you have 100,000 secondary power for sale at a price of 0.75 mill (proposed as a basis of cost estimate by the Ordnance Department and the Nitrogen Fixation Laboratory), I should like to have that 100,000 secondary power at that price and plant No. 1 at the price estimated by the Ordnance Department. If I can get them I can get the necessary funds to put it through and run a successful nitrogen-fixation industry which will produce nitrogen as cheaply as it is produced anywhere in this country.

Senator NORBECK. May I ask him in this particular case what do you mean by secondary horsepower?

Doctor PARSONS. The secondary horsepower is that portion of the power which is not available for 12 months of the year.

Senator NORBECK. Yes; I understand, but secondary power can be that power which is available for 11 months, 9 months, or 6 months. Which is it you want?

Doctor PARSONS. The 10 months' power. That is brought out in my offer.

Let me read my letter to the Secretary. [Reading:]

MARCH 23, 1922.

Hon. JOHN W. WEEKS,
Secretary of War, Washington, D. C.

MY DEAR MR. SECRETARY: I am handing you herewith an offer covering certain of the properties at Sheffield, Ala., and the first 100,000 kilowatts of secondary power to be derived from the proposed water-power development at Muscle Shoals, which I trust may receive your favorable consideration and the favorable consideration also of Congress.

You may or may not be aware that for several years I have been in close touch with the fixed-nitrogen situation, both in this country and abroad; first, as chief chemical engineer of the Ordnance Department, transferred thereto from the Bureau of Mines at General Crozier's request to make a study of the European nitrate situation

preliminary to the installation of nitrogen-fixation plants in this country, ar throughout the war, as a member of the nitrate commission in frequent con with Secretary Baker, Assistant Secretary Crowell, and the officers of the C Department, especially those of the nitrate division. I have since made th to Europe and have kept in constant touch with the advancements in nitr ation and with the individual engineers, chemists, and chief executives of the fixed-nitrogen plants abroad as well as in this country. I have the n experience and knowledge of new methods to direct the design and installa synthetic-ammonia process at plant No. 1 which will operate commericall patent situation offers no difficulties.

I have constantly advised that the cyanamid process was becoming obs while the synthetic-ammonia processes—variously designated under the n Haber process, the Claude process, and the General Chemical process—w idly becoming the sole commercial procedure for the fixation of nitrogen tilizer and explosive use. The practical obsolescence of the cyanamid throughout the world, as detailed in my recent testimony before the Military Committee on March 13, is in entire accord with my prediction. The rem success of the General Chemical Co.'s synthetic-ammonia process in its sec stallation at Syracuse entirely justifies its first trial installation at plant Muscle Shoals. The fact that a plant to produce 100 tons of fixed nitrogen is on the way to completion, using a similar process, at Billingham, England; that an immense cyanamid plant at Odda, Norway, nearly one-half the siz cyanamid plant at Muscle Shoals, was sold on February 11 for 50,000 kroner, a mately $10,000 present exchange or $16,000 at normal exchange; the fact t Norwegian plant is planning to convert its water power to exactly the sam suggest in the accompanying offer, using a synthetic-ammonia process; and that installations of similar synthetic processes are under way in France, Ita Japan, is proof of the correctness of the stand I have always taken.

In order that the accompanying offer may not exclude anyone who may dif me as to the possibility of operating commercially for cyanamid at plant No. visions are made so that this plant may be operated by others if the Govern elects and can find lessees therefor.

This offer is made with the intent of developing at Muscle Shoals an indu the fixation of nitrogen which has possibilities of a greater output of fixed n than can be produced at plant No. 2. It contemplates the production of carbide and of acetylene therefrom for use in autogenous welding. These p will be made especially with a view to the utilization of a part of the oxy produced, otherwise as a waste product, in the electrolytic production of hy In view of the extended discussion in the public press of philanthropic fertili duction, I wish to state frankly it is intended to operate these plants for b purposes, with the expectation of a fair business profit.

If the offer is accepted and the water power is allocated to the company I will form, plant No. 1 will be converted into a plant for the fixation of nitr the Haber process or a modification thereof. This process is turning out to Germany 300,000 tons per annum of fixed nitrogen, equivalent to nearly 1. tons of ammonium sulphate, which is sold in Germany on a basis of between $30 per ton, equal to about one-half of the price for ammonium sulphate in A The conditions in Germany are, of course, unusual, but rapid advancements a made in the Haber process, and there is every reason to believe that if plan is operated that it will have at least a stabilizing effect upon the fertilizer mark since the supply will be greatly increased, will tend to decrease the market nitrogenous fertilizer.

The company will also undertake to operate certain of the carbide furnaces production of phosphoric acid and potash if it is found that it can be done pr by electrothermic methods.

In closing I think I should add, to forestall unnecessary comment, that have assurance of financial support which will enable the company to meet its tions as they may mature, this offer is made without the knowledge or connivi without expectation of connection with any of the parties who have so far bee tioned before the Military Affairs Committee as interested in the Muscle situation. Those to whom I refer are acting from no standpoint of assistanc tagonism to any offer now before Congress, but simply with the hope of develo important profitable industry in Alabama and Tennessee if the water power b available either through the acceptance of the offer of the Alabama Power through the Government itself completing Dam No. 2 and offering the power th for sale.

Sincerely yours,

CHARLES L. PAR

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MARCH 23, 1927.

Hon. JOHN W. WEEKS,
Secretary of War, Washington, D. C.

SIR: I beg to submit to you, and through you to the constituted authorities for proper action, the following offer, which will become binding upon approval by Congress, if approval is obtained within one year from date:

1. I agree to form a company, to be known as the Southern Nitrate Co., which will organize a corporation to be known as the Southern Nitrate Corporation. Securities of this corporation, after being properly underwritten, will be offered at public subscription. Until the public has had an opportunity of purchasing these securities the company will be controlled by the undersigned. The company, or its successor, will enter into such contracts as may be deemed necessary by the Government for the company to effectuate the following proposal:

(*a*) The company will purchase the first 100,000 kilowatts of secondary horsepower, developed from the dam or dams to be constructed at Muscle Shoals, at a price of 0.75 mill per kilowatt hour, delivered at the switchboard, for power available for 10 months during any calendar year and a proportionate per month price for such portion of the aid 100,000 horsepower as may not be available for the full period.

(*b*) The company will purchase for the sum of $600,000 all of the property constituting plant No. 1 (as officially known and designated), including lands, steam and power plants, buildings, material, machinery, fixtures, equipment, apparatus, appurtenances, tools, supplies, rights of way and transmission lines, and the right, license, and privilege to use any and all of the patents, processes, methods, and designs which the Government may legally use in plant No. 1, except such patents and designs acquired from the General Chemical Co., which may not legally be transferred to others; provided, that the Government will first remove, without cost to purchaser from plant No. 1, such apparatus connected with the process of the General Chemical Co. for the fixation of nitrogen as was designed by the engineers or employees of the General Chemical Co. and which may not be legally or rightfully used under the Government's constructural relations with that company.

(*c*) As a condition of the above purchases, the company requires—

(1) The option to lease the carbide plant, constituting a portion of plant No. 2, with land, transmission lines, rights of way, and other necessities appropriate to its operation now on the premises, including the buildings, material, machinery, fixtures, equipment, appurtenances, housing facilities, tools, and supplies, together with the liquid air plant and its lands, buildings, and appurtenances, for the sum of $50,000 per annum.

(2) An option to purchase all of the property constituting the Waco quarry, including rights of way, buildings, material, quarry tracks, machinery, railroad tracks, appurtenances, tools, and supplies for $200,000 or to lease in lieu of purchase for $20,000 per annum.

2. If the above offer is accepted by the Government, the company will agree to operate plant No. 1 as an air nitrogen fixation plant and to utilize such portion of the power as is appropriate and can be profitably employed for the electrolysis of water for the production of hydrogen—the basic and most costly raw material of the synthetic ammonia process—any oxygen to be utilized as rapidly as is commercially feasible. The company agrees to operate the carbide plant either for the manufacture of calcium carbide and/or, so far as commercially profitable, for the production of phosphoric acid and potash by electrothermal methods. The company will maintain a research laboratory to develop, if possible, cheaper and more economical methods of procedure for the fixation of nitrogen and for the production of electric furnace products. The company will also agree to keep such portion of plant No. 2 as it may lease in good condition and available to the Government at once in any emergency.

3. The company will agree, in case the Government leases the cyanamid, ammonia oxidation, or the ammonia nitrate plant connected with nitrate plant No. 2, to furnish to any lessee the Government may nominate the calcium carbide it may require for the production of cynamid or fertilizer products therefrom at a profit of 6 per cent. It also will agree to furnish at cost to such lessee for the purpose of producing cyanamid such power and such pure nitrogen gas as may be necessary to efficient operation.

Trusting that the above offer may meet your approval and the approval of Congress, I am,

Sincerly yours,

CHARLES L. PARSONS.

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Senator NORBECK. Your offer includes those residences as well as other property on the ground?

Doctor PARSONS. Yes, sir.

Senator NORBECK. There are 85 of those residences on the ground.

Doctor PARSONS. $600,000 is the price given by General Williams.

Senator KENDRICK. That does not include the steam plant.

The CHAIRMAN. Oh, yes.

Senator KENDRICK. The big steam plant.

The CHAIRMAN. Oh, no; the little one.

Doctor PARSONS. The one at plant No. 1.

The CHAIRMAN. It includes everything at plant No. 1?

Doctor PARSONS. At No. 1; yes.

The CHAIRMAN. And nothing else?

Doctor PARSONS. Yes; and nothing else.

I don't see that that offer requires any action on the part of this committee unless you should be in position to accept the Alabama Power Co.'s offer or complete the work yourselves. At the same time I thought it proper to explain with reference to it, and I have tried to put everything clearly before you, so that there would be no question.

The CHAIRMAN. There is one thing that arises in my mind. You get 100,000 secondary power, but there is just a little difference of opinion among the experts as to whether some of what is considered primary power might not technically be secondary power. For instance, they say we get 87,300 horsepower that they call primary power at Dam No. 2, but, as a matter of fact, could not some of that be technically called secondary power, because it is only 97 per cent of the time that there would be 87,300 horsepower available.

Major BURNS. You would have 87,300 horsepower available 99½ per cent of the time.

Doctor PARSONS. That is primary power. In most years you would have it more than that.

The CHAIRMAN. Yes; most years more than that. But to be real technical, now, that is not really primary power, is it?

Doctor PARSONS. It is not always an easy matter to separate exactly between primary and secondary power where you have a fluctuating flow, but contracts have been drawn between water power companies covering that question, and could be drawn so that it is understood by all parties and would be administered equitably.

The CHAIRMAN. What would be your understanding, Doctor, as to the amount of primary power?

Doctor PARSONS. Down there?

The CHAIRMAN. Yes.

Doctor PARSONS. Exactly as given you by Major Burns. He is better prepared to speak than I am.

The CHAIRMAN. You would count 87,300 horsepower as primary power?

Doctor PARSONS. Yes, sir.

The CHAIRMAN. Even though it is available only 99½ per cent of the time?

Doctor PARSONS. Yes, sir.

The CHAIRMAN. What about these patents? Are we going to get into trouble, and would we be in trouble about the patents on the Haber process?

Doctor PARSONS. No, sir, I think not. I can not see but what the patent situation, so far as the Haber process is concerned, is practically free. The Haber patents were all taken over by the Alien Property Custodian and belong to the Chemical Foundation and are available to any American company on the same terms with any other American company. That, I think, is definitely determined, and it is generally known. The specific patent of the General Chemical Co. to operate under 100 atmospheres could not be used without reference to the General Chemical Co., but it makes very little difference whether you operate at 99 or 101 atmospheres.

The CHAIRMAN. Well, in the construction of plant No. 1 where all of those concerns had new developments and found out what their mistakes were, did that result in any patents being issued for the improvements that were brought about by the joint action of the Government and the company?

Doctor PARSONS. I know of no patents that would stand in the way of the operation of that plant. However, I am one of those that believe very strongly that the United States Government and the people of the United States do not wish, and can not afford to treat any of their contracts, when they are issued in good faith, as "scraps of paper," contracts that are morally binding, even though there may be certain legal technicalities. Therefore, I believe that any arrangement we made with the General Chemical Co. about the use of their patent should be strictly held to, and that is why I put in my offer that any apparatus built by them should be removed from the premises and not considered a part of the purchase. We have not asked for the privilege of the use of any of their patent rights.

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The CHAIRMAN. Well, you did not understand me; probably I did not make myself clear; but, as I understand it, in the construction of this plant there was some kind of a contract between the Government and those who were constructing it about the improvements that should be made in the meantime by the cooperation of the Government experts and their experts. Now, as I understand it—and I may be wrong about it—that cooperation did result in several improvements.

Doctor PARSONS. Yes.

The CHAIRMAN. Were those improvements patented?

Doctor PARSONS. Not so far as I am aware. They were almost solely improvements in mechanical strength, in making their pressure cylinder heads stronger, so that they would not bulge; in fixing up various places where there were leaks; but more especially the improvement has been made in the catalyst. That is the substance which is essential for the combination of nitrogen and hydrogen to form ammonia. Now, the catalyst which the General Electric Co. uses to-day is entirely different from the catalyst which was used in plant No. 1 at Muscle Shoals. That catalyst did not function because they could not make it on a large scale as they did in the laboratory. They now have a secret catalyst. The Nitrogen Fixation Laboratory also has developed a catalyst in the last year, which is superior, in my opinion, to any other catalyst in the world.

The CHAIRMAN. That is a Government laboratory?

Doctor PARSONS. The Government laboratory, and that would be available to any plant which might be added in plant No. 1. That was discovered by Government employees.

Senator NORBECK. The information I got from one of the engineers was that the failure of the Haber process at Muscle Shoals was due to the fact that they attempted to carry 1,500 pounds of pressure in steel pipes at the same time that they carried a temperature of 1,500 centigrade.

Doctor PARSONS. No; that was around 500°, Senator.

Senator NORBECK. Oh, 1,500 Fahrenheit?

Doctor PARSONS. No; it is 1,500 pounds pressure per square inch and about 500° centigrade.

Senator NORBECK. And they were not able to get pipes that would carry that pressure, with that heat?

Doctor PARSONS. That was one of the difficultes that arose.

Senator NORBECK. Can that particular thing be removed?

Doctor PARSONS. Oh, yes. It has been in all of the plants operating in the world, because they are all working under similar or more difficult conditions.

Senator NORBECK. By the manufacture of pipe that will stand pressure at high heat?

Doctor PARSONS. No.

Senator NORBECK. No such pipe was available at the time of this construction?

Doctor PARSONS. Yes; but they have had to find out these things by trial.

Senator NORBECK. That is practically the same experience that the German people had in building their plant?

Doctor PARSONS. Exactly, and that was the experience at Muscle Shoals in plant No. 1 which had to be closed down at the time of the armistice.

Senator NORBECK. It is your idea that if our people could have kept on for another year, they would have operated that Haber plant successfully at Muscle Shoals?

Doctor PARSONS. That is not only my idea, but that is the idea of everybody that had any connection with the plant.

Senator NORBECK. And in your opinion that would have resulted in a much cheaper output than would have been produced at the other plant?

Doctor PARSONS. Unquestionably.

Senator HEFLIN. What do you think it would cost to put the Haber plant in operating condition at plant No. 1?

Doctor PARSONS. I think, with the material already there at plant No. 1, to bring it up to a 30-ton-per-day capacity—which is the capacity originally estimated—it would cost in the neighborhood of $2,000,000. I am lower in that figure than are some of the Ordnance people. They may be nearer right than I am, but I have a pretty good basis for my calculations, because I know something about costs in other plants.

Senator HEFLIN. You think, then, that with the expenditure of $2,000,000 it could be made a perfectly good plant?

Doctor PARSONS. It could be made a perfectly good plant to that extent; yes, sir.

The CHAIRMAN. Then, what would its capacity be?

Doctor PARSONS. Thirty tons of ammonia per day. I am merely talking about the plant itself. There may be other accessories that will have to be put in which will cost more, as was the condition when the original plants were put in down there. Of course, the so-called cost of plant No. 1 was originally estimated at about $7,000,000,

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and it really cost $13,000,000, but the $13,000,000 included many things not estimated for in the first estimate, like the ammonium nitrate plant, the oxidation plant, the plant for the concentration of nitric acid, and other things.

Senator NORBECK. And those 85 residences.

Doctor PARSONS. Yes, sir; the residences and the water works and railroad tracks. I am not prepared to say that I should not like to have more than $2,000,000 available if I were going to undertake the work, but I believe the plan can be carried out and the plant put in operation for that amount.

The CHAIRMAN. Were you there during the construction of plant No. 1?

Doctor PARSONS. Yes, sir. Yes and no. I was there during the whole latter part of the construction of plant No. 1.

The CHAIRMAN. Were you located there?

Doctor PARSONS. Oh, no, I was not located there. I beg your pardon.

The CHAIRMAN. What portion of your time did you spend there? Were you actually engaged in the construction?

Doctor PARSONS. I was not, in any sense at all.

The CHAIRMAN. What was your purpose in going down there?

Doctor PARSONS. I went there as a member of the Nitrates Commission.

Senator NORBECK. If that plant is remodeled at a cost of approximately a couple of million dollars, as you suggest, you are satisfied that, in all probability, it will operate successfully?

Doctor PARSONS. Yes.

Senator NORBECK. In that event, how much cheaper will they produce than will the cyanamide plant which is there?

Doctor PARSONS. I should have to have a number of basic facts to go on to answer that question.

Senator NORBECK. Would you be willing to look that up?

Doctor PARSONS. I can answer your question here, if you will get down to the points, so that it will be correctly answered when I have answered it.

Senator NORBECK. Yes.

Doctor PARSONS. Do you assume that you will use the secondary power to produce your hydrogen, or do you calculate that you are going to use your steam power to produce your hydrogen?

Senator NORBECK. Let us assume that the horsepower cost three-fourths of a mill on the cyanamide process. How much cheaper, if any, do you think you could produce under the Haber process, with the present steam plant, after you have remodeled it, as you suggest?

Doctor PARSONS. I think you could produce ammonia for from 75 to 80 per cent of the price that you could hope to produce it with the cyanamide process.

Senator NORBECK. Even with that very cheap power?

Doctor PARSONS. Yes; even with that very cheap power, from 75 to 80 per cent, and perhaps less. The Ordnance Department and the Nitrogen Fixation Laboratory have estimated that they can produce ammonium sulphate at plant No. 2 on the basis of about $65 per ton—that is, under commercial conditions—$65 per ton of ammonium sulphate. Now, I do not think they can; in fact I feel absolutely certain that they can not.

Senator NORBECK. You think it would cost how much?

Doctor PARSONS. At least $75 and perhaps $80.

Senator NORBECK. And you think, with the Haber process and with the secondary power, you might produce it at how much?

Doctor PARSONS. Around $50 a ton. That is, if you operate it by a commercial concern.

Senator NORBECK. May I ask you this question, Doctor? Out of this $50 or $60 a ton what part of the expense would be power?

Doctor PARSONS. Again, you must take into consideration whether you are going to use power to produce your hydrogen or coal to produce your hydrogen?

Senator NORBECK. I mean after you have remodeled it at an expense of a couple million dollars, as you said awhile ago.

Doctor PARSONS. If you are going to produce power to produce hydrogen——

Senator NORBECK. Is that what you have implied when you say you would remodel your plant by spending a couple million dollars on it?

Doctor PARSONS. That is the method I should use down there, yes. I am afraid I will have to put that in the record, to be accurate.

Do you know what it is, Major [addressing Major Burns]?

Major BURNS. According to that scheme you would use about 4,000 kilowatts per ton of ammonium sulphate. On the basis of a mill per kilowatt hour, your power cost would be $4 per ton of ammonium sulphate. On the basis of 4-mill power it would be $16 per ton.

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Doctor PARSONS. I am talking about mill power only.

Major BURNS. Assuming it at $50 a ton, your power charge would be $4 and your percentage would be 8 per cent, or 4 divided by 50. That is in round figures..

Doctor PARSONS. You are considering making the hydrogen electrolytically.

Major BURNS. That is what I understood you to say.

Doctor PARSONS. I do not have those figures in my mind. I have had them all calculated out, and I can give them to you exactly.

Senator NORBECK. We are trying to find out how much it will help toward the cheapening of fertilizer.

Doctor PARSONS. The only power at Muscle Shoals that will do any good is that secondary power.

The CHAIRMAN. You would have to do that with the Haber process.

Doctor PARSONS. You would have to do it with the Haber process. In my opinion you can not use secondary power or any other power, even if your power cost you nothing, to run the cyanamid plant and make fertilizer at any cheaper rate than it is to-day. I think you ought to examine quite carefully the various records bearing upon that matter. I think you ought to get the so-called Exhibit B that was introduced in the House hearings, put in by the Ordnance Department, in which they made their estimate of the operation of the cyanamid plant, showing, at the request of Mr. Fields, what the outcome would be in operating that plant for six years.

They estimated that if we should operate that plant for six years, we would lose $2,919,000, and in order to get that loss they have taken the ammonium sulphate at $65 a ton. That price for ammonium sulphate is not "cheap fertilizer." Ammonium sulphate in 1921 sold for an average of less than $50 a ton. It sold for $40 a ton, and there was a lot of it that was sold in the low thirties. If you take $50 a ton as the price of ammonium sulphate in plant No. 2, according to the estimate of the Ordnance Department—and, in my opinion, those estimates are low—you would lose in those six years over $22,000,000 by operating the plant. That is on the basis of secondary power.

Senator NORBECK. And you would not be furnishing cheap fertilizer.

Doctor PARSONS. That is on the basis of $50 a ton for ammonium sulphate.

Senator NORBECK. That is not a cheap fertilizer?

Doctor PARSONS. It is more than the average price for the last year.

The CHAIRMAN. Now, to get down to a practical solution of that difficulty, it would be your judgment, as I understand it, that plant No. 2 is useful and should be considered and kept as a war proposition, and that the other plant, under the method you have described, should be operated by secondary power. Is that about right?

Doctor PARSONS. That is right; yes, sir.

The CHAIRMAN. If the Government, for instance, retains it?

Doctor PARSONS. But basic to all of that, I want to go very strongly on record by saying that no matter what you would do at that plant, through that power, you are not going to get "cheap fertilizer" for anybody.

Senator HEFLIN. Mr. Ford says he can make cheap fertilizer if we give him that power under the arrangement that he has suggested to the Government.

Doctor PARSONS. It is important, I think, that you should all read very carefully both the House records and the Senate records. Mr. Mayo is unquestionably a most excellent engineer and understands water power and engineering propositions, but he has shown throughout his testimony that they have had nobody that was familiar with fertilizer production advising them at all. His testimony is decidedly varied as given before the House committee and this committee. It has been distinctly changed. In the House committee he stated several times that they would not operate plant No. 2 at all, unless they could operate it at a profit. That is shown to be Ford's statement and the belief also of practically everyone who has studied the situation among the higher officials. For example, Secretary Weeks shows very clearly in his testimony that he does not consider that this offer carries any real assurance in any way that any fertilizer or nitrate will be made.

General Williams says:

"If the Ford offer means, in the case of the No. 2 plant, that such plant will be operated at its approximate capacity for the fixation of nitrogen," etc.

General Beach says:

"Direct benefits accruing to the United States are (b) production in the interest of public welfare of large amounts of fertilizer at a cost not exceeding the reasonable cost of production, providing that the production of nitrates adapted to fertilizer purposes is found to be practicable."

The Secretary of Agriculture in his statement to you was no less noncommittal. The authorized statement given out by Director Tolman favors the Ford offer only "if its terms are sufficiently definite and binding to make sure that the plant will be operated continuously for the manufacture of fertilizer."

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Mr. Ford, according to Secretary Weeks, states definitely that plant No. 2 will not be operated unless it can be operated at a profit, and Mr. Mayo definitely confirms this statement in his testimony before the House committee.

Now, as to the question of price, I specially had copied from the record the following, if I may put it in to show where that question of the "one-half price" arose, and to bring out another point which Mr. Mayo, I think, did not bring out in his testimony here, namely, that before the House committee he said that the offer meant they would make 2,000,000 tons of fertilizer. Here he simply spoke of 110,000 tons of ammonium nitrate, and there is a very great difference between the two.

Senator HEFLIN. He testified here that it was Mr. Ford's intention to manufacture fertilizers on a large scale.

Doctor PARSONS. The difficulty in the whole situation is the question of Mr. Ford's intention, but the thing that you want is Mr. Ford's guaranty. I am sorry that Mr. Ford has not himself come here and put himself on record.

Senator HEFLIN. He has modified his proposal somewhat, you know, and states that he agrees to make commercial fertilizers.

Doctor PARSONS. As to the commercial fertilizers, I will bring that out. May I read you this paragraph?

The CHAIRMAN. Yes.

Doctor PARSONS. It is as follows:

"Mr. GARRETT. You stated in answer to a question by some gentleman here this morning that you thought he could make fertilizer 50 per cent cheaper than it is to-day.

"Mr. MAYO. We think so; yes, sir.

"Mr. GARRETT. On what do you base that statement?

"Mr. MAYO. Well, we base that on a number of processes, any one of which we may adopt."

And all through his testimony it has been "any number of processes." They apparently have not any expert advice on the nitrogen situation whatsoever.

Senator. HEFLIN. He claims they have a secret process.

Doctor. PARSONS. Yes; he talks about that, and he also says that they have a process of making fertilizer as an adjunct to electric steel and aluminum. That process has been well known for fifteen or twenty years, and if he did not have any process three months ago, I do not think, as he has no nitrogen experts with him, that in three months he has developed anything very wonderful or has brought it out in a way that would give you any basis for accepting it.

Senator. HEFLIN. But, of course, you do not know whether he has or not.

Doctor PARSONS. No; nobody knows anything about it at all; but we do know that the lime slag iron obtained from iron ore which contains phosphate takes the phosphorus out of the iron ore, and this so-called Thomas slag has been used for fertilizer purposes in Europe and in America for a long time. We also know in connection with the manufacture of aluminum, that there has been a process originally devised by Serpek in France, and worked in this country by the Aluminum Co. of America, and which has been abandoned by both after the expenditure of hundreds and hundreds of thousands of dollars, it having been found to be entirely impractical. In my opinion it will always be impractical, on account of the very high heat that has to be used, and various other conditions.

I will go ahead with this testimony now, if I may:

"Mr. GARRETT. You mean that you have in mind processes for the manufacture of fertilizer that have not yet been developed by any of the other companies?

"Mr. MAYO. Yes sir; or partly developed by some of them.

"Mr. GARRETT. What I want to get at is this: Regardless of that, because that is something we do not know about now, but we do know that fertilizer is being made, and how it is being made, and how it is being distributed now.

"Mr. MAYO. Yes, sir.

"Mr. GARRETT. And what I want to get in the record is how much cheaper can Mr. Ford, in your opinion, make fertilizer at this plant if the Government accepts his offer, at the rate of about 2,000,000 tons per year than it is being made generally throughout the country?"

Mr. Mayo at those other hearings testified that 2,000,000 tons of fertilizer was the equivalent of 110,000 tons of ammonium nitrate, simply because the 2,000,000 tons does contain the same amount of nitrogen as the 110,000 tons, forgetting that if you made all of those things by the electrothermal method you would be using more power than Muscle Shoals would supply.

"Mr. MAYO. Of course, we are green at the fertilizer business, and I could not exactly say, but Mr. Washburn in his statement said he thought it could be made there at about one-half the price."

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There is the original basic thought upon which all of this one-half price has been based. Mr. Washburn, in his original talk before the House committee, before the war, when he was trying to get Muscle Shoals developed, thought that he could make fertilizer down there for one-half price, and Mr. Mayo simply adopted that statement, and, in my opinion, he has nothing else whatever to go on, for, as I have said before, if you take 2,000,000 tons of fertilizer, and put in it the total amount of nitrogen that is present for nothing, it would not reduce it 33⅓ per cent.

"Mr. GARRETT. Do you think you would be safe in saying to the committee, as the spokesman of Mr. Ford, that it would be made 33⅓ per cent cheaper than it is being made and distributed to the farmer now?

"Mr. MAYO. Yes, sir."

Now, if you could get him to guarantee that 2,000,000 tons of fertilizer a year and a 33⅓ per cent reduction in price, I am for the Ford offer.

Senator KEYES. In your opinion could that plant No. 2, under this proposal or any other proposal made to this committee, be operated so as to materially reduce the price of fertilizer to the farmers of this country?

Doctor PARSONS. No, sir; I do not.

Senator HEFLIN. Then, you do not think there is any hope for fertilizer users in this country; that it must remain in the hands of the fertilizer trust?

Doctor PARSONS. I do not think there is any fertilizer trust, Senator.

Senator HEFLIN. Don't you?

Doctor PARSONS. I have seen in the last few years the strictest competition between them. I think if you will look into their profits that the stock has been down to almost nothing in all cases, and they have been paying no dividends. As to there being any "trust," I think it is just as much a shibboleth as the question of this "cheap fertilizer." I do not own any fertilizer stock, nor am I interested, directly or indirectly, in any fertilizer company, but I believe that is absolutely true. Now, the more fixed nitrogen you can produce and the more you develop methods for production, the more you decrease the price of fixed nitrogen to the farmer in his fertilizer. I am thoroughly desirous of seeing that accomplished, and I believe it is going to be accomplished, but it is not going to be accomplished through Muscle Shoals or any other power proposition.

Senator HEFLIN. Why, then, do you suppose these commercial fertilizer concerns are fighting the Ford offer, unless they are afraid that he will reduce the price of fertilizer?

Doctor PARSONS. If they think that a man is going to have an immense business given to him on a gold platter with a bonus, they naturally hesitate to have the supply of the country increased by 25 per cent under those conditions, to compete with them immediately, because it would probably be a very serious thing. At least, that is the way it seems to me. Now, when you give that immense power to a person simply on the basis of cheap fertilizer, you are giving one of the biggest subsidies ever given in American history to any one man. I do not care whether it is Mr. Ford or anyone else. Mr. Ford, of course, is a dreamer of dreams, one of which has come true, and Mr. Mayo said that this cheap fertilizer was one of his dreams. In that connection Mr. Mayo has said:

"It is Mr. Ford's dream in regard to this fertilizer product to make the price of it such that anybody can use it in any quantity they wish to; that the expense would not prevent them from using all they should use."

That is a beautiful dream and I hope it will come true, but I maintain it is not coming true through Muscle Shoals.

Senator HEFLIN. You know, some of them claim that they will use 500,000 horsepower in that river at those three dams. What do you think of that?

Doctor PARSONS. Five hundred thousand horsepower?

Senator HEFLIN. Yes.

Senator KEYES. For what purpose?

Senator HEFLIN. For any purpose.

Doctor PARSONS. When they get those dams going—and do not misunderstand me; I am not against the building of those dams to get the power for industrial use, I am for it; but I do not want to see it developed under a false premise. You need those industries in Alabama, you need those industries in Tennessee, and you need those industries in my own home State of Georgia. You need that power for the development of our industries. There is only one great fault, you must remember, and that is that the people down there have the idea that this will bring in thousands of people, as they thought would be the case at Niagara Falls. The actual facts are that when they developed Niagara Falls, taking into consideration the textile industry at Lawrence, they thought they were going to get a city of 3,000,000 inhabitants, and they did not get more than 15,000. Down there, you will not get any more, because it will not require that many people to run it. Electrochemical industries do not mean

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people. I want to see the dam completed and the power used all through the South, the same as around New York and other places.

Senator HEFLIN. You do not want to see Mr. Ford's offer accepted, do you?

Doctor PARSONS. I do not believe any such asset as that immense power should be given as a bonus to any American citizen. You should either sell it properly or you should develop it yourselves.

Senator HEFLIN. Well, if he should be able to manufacture cheap fertilizer, it would be a great service to millions of farmers, would it not, if the Government let him have it?

Doctor PARSONS. I think the getting of cheap fertilizer would be a great service to the American farmers; yes, sir; but it is not coming that way.

Senator KENDRICK. I would like to ask you a question right there, Doctor Parsons. Is it your opinion, based on statements you have made, that the Government owning and controlling power and leasing such of it as there may be found a market for, particularly the primary power, and proceeding in its own way to keep one of those plants operating for the production of nitrogen, would be just as apt, even more apt, to reduce the cost involved in the production of nitrates as any private individual or corporation?

Doctor PARSONS. No, Senator; I am not in favor of Government operation of any commercial organization of this kind. If you go into the production of nitrates by the Government it means that you will have to take up the whole fertilizer business, and it means——

Senator KENDRICK. I want to interrupt you there to say that the primary purpose of the whole scheme has been, or that is, it was in its initiation, to provide nitrates for the use of the Government in war time.

Doctor PARSONS. Quite right.

Senator KENDRICK. Now, in order to have an effective and efficient plant for the production of nitrates when war comes, this plant or some other plant must be kept in operation.

Doctor PARSONS. I agree with you very heartily.

Senator KENDRICK. So it would not be entirely a commercial proposition.

Doctor PARSONS. What I personally believe in is that plant No. 2 should be kept in a stand-by condition at a cost of something like $100,000 a year. It can be ready to operate at a moment's notice, until such time as we have other reserves, so that there will be no need for keeping it. I am of the opinion that the fixation of nitrogen will be developed most rapidly and most efficiently by private competition, and I believe that private competition is in sight. I do not believe that anyone has a monoply of ihe fixation of nitrogen in this country, and that it is quite possible, and in fact practically certain, that there will be strong competition in the development of synthetic ammonia processes. The future fixation of nitrogen is going to be through the synthetic processes, although, of course, no one is prepared to state that some wonderful discovery may not be made to-morrow. I do not wish to intimate that we have improved as much as we will untimately improve it, or to be through, but the use of the synthetic processes is the present outlook. Now, personally, I believe you would get furthest by carrying out exactly the plan I have put in my offer there, that plant No. 1 should be sold, we will say, to the highest bidder, and that the secondary power to operate that plant be in some way furnished.

Senator HEFLIN. So it is possible, then, you say, for the discovery any day of a process that will produce the stuff cheaper than it is produced to-day. Now, Mr. Ford says that he has a secret process by which he will be able to make it much more cheaply than it is made to-day.

Doctor PARSONS. There was a lecture given by Mr. Ashton at the Cosmos Club a few days ago in which he stated that the first man who set free the energy which we know to be present in the atom might, by that very act, set free the energy of all of the atoms and thereby blow the earth into a nebula. I think there is as much probability in one as in the other. I am willing to say that both of them are possible.

Senator HEFLIN. You think it is possible for somebody to discover something to-morrow that will be a much cheaper process than that which you have to-day, yet you think it is impossible for Mr. Ford to get hold of one of those processes.

Doctor PARSONS. I did not say that I thought it was impossible. I said it was just as probable he had developed this wonderful secret process in two months as the other of those two things which I mentioned. I am not denying the possibility of anything, Senator.

The CHAIRMAN. Now, Doctor Parsons, I want to get back to where I started out with you when somebody else took you away from me. At that time I had not gotten out what I wanted to get out. You were talking about operating plant No. 1 on

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secondary power. Will the secondary power that will be made, say, for 10 months in the year, be more than enough to operate plant No. 1 under your plan?

Doctor PARSONS. That depends entirely on the extent to which plant No. 1 is enlarged. It would be much more——

The CHAIRMAN. I am speaking of it as it stands now.

Doctor PARSONS. It would be much more than enough to operate it as it stands. The actual fact is that with 100,000 secondary power available 10 months of the year, it will give just about the output that No. 2 would give, provided there was the necessary installation at No. 1 to utilize that power for the electrolysis of water.

The CHAIRMAN. Then, it would mean this, that there would be secondary power enough developed at Dam No. 2 to operate the Haber process planned under your plan, with an annual capacity of 40,000 tons of nitrogen?

Doctor PARSONS. You have it absolutely right, Senator. It would be slightly in excess of that.

The CHAIRMAN. That would mean as much as a war proposition as nitrate plant No. 2 could do running to its full capacity, regardless of expense?

Doctor PARSONS. It would mean very much more as a war proposition, simply because you would have an operating plant, a modern commercial plant, and you would have to keep that up to date all the time.

The CHAIRMAN. To do that, how much would you have to increase the capacity of plant No. 1?

Doctor PARSONS. Five times.

The CHAIRMAN. Five times; and how much money would it cost?

Doctor PARSONS. Government built or privately built?

The CHAIRMAN. Well, both ways. Give it to us both ways.

Doctor PARSONS. Well, I should want around $15,000,000 to $20,000,000.

Senator NORBECK. For which way?

Doctor PARSONS. Am I going to do it?

Senator NORBECK. Give it to us the private way and the ordinary Government way, so that we can have the comparison. It would be $30,000,000 Government built, then, would it?

Doctor PARSONS. I do not think I had better make that comparison, Senator. I think that, efficiently done, $15,000,000 to $20,000,000 would cover the situation. That is the best way for me to put it.

Senator NORBECK. The chairman and I do not agree on the degree of Government efficiency.

The CHAIRMAN. I want to have it in the most efficient way.

Doctor PARSONS. I think $20,000,000 would be sufficient.

The CHAIRMAN. Well, you are speaking now of letting it by contract to some private individual, and if you mean that is the efficient way, that is the way I want you to make your estimate.

Doctor PARSONS. No; I would not let it by contract.

The CHAIRMAN. Well, the cheapest way that you could do it and have it good.

Doctor PARSONS. Well, say $15,000,000.

The CHAIRMAN. All right.

Doctor PARSONS. I would like to have the privilege of placing that figure in the record.

The CHAIRMAN. All right, if you care to. I would like to know the figure.

Doctor PARSONS. But I think that is essentially correct.

The CHAIRMAN. When we reach that point——

Doctor PARSONS. Major Burns said he would put it at $20,000,000.

The CHAIRMAN. How many years would it take to have that done? It would not take more than a year or two, would it?

Doctor PARSONS. Oh, yes, sir. Nobody ought to go at a matter of that kind at once. It would not be a proper procedure. You ought to build your first 10-ton unit and operate it for six months and then increase to your 30 and operate that for a year and a half, and then go ahead and put in your full construction. Remember, you can not do anything with this until you get your secondary power.

The CHAIRMAN. I am asking you to outline it. It would take three or four years before you would be consuming your secondary power?

Doctor PARSONS. Yes, sir.

The CHAIRMAN. To its maximum, at that one dam. Now, in the meantime, you would have a lot of secondary power to sell if you could find a market for it, under your plan?

Doctor PARSONS. There is very little market for secondary power there.

The CHAIRMAN. That is true, unless it is something that it is peculiarly situated, so that the people need the power.

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Doctor PARSONS. That is why I put in the lease. I hoped I might use it for the phosphoric acid and carbide.

The CHAIRMAN. During that time you would be able to sell 87,300 horsepower.

Doctor PARSONS. Oh, if you owned the primary power and there was a market for it.

The CHAIRMAN. Yes.

Doctor PARSONS. But that does not come in a minute.

The CHAIRMAN. Oh, no; I understand that.

Dr. PARSONS. Even then you might not get all of your market for all of your primary at once in the best way.

If you will allow me to add one other thing on the question of operation, you can not hope to do this efficiently and get the right people to handle it for any such salaries as you have put in your bill.

The CHAIRMAN. I am going to take up that feature of it with you later, but right now I am speaking of something else. I want to get your ideas in the record and not mine.

Doctor PARSONS. Yes, sir.

The CHAIRMAN. When that time comes, at the end of three or four years, with plant No. 1 operating to its capacity, we can scrap plant No. 2, even as a war proposition?

Doctor PARSONS. Quite right.

The CHAIRMAN. What would be its value?

Doctor PARSONS. But you have a very valuable steam plant in plant No. 2.

The CHAIRMAN. And we would probably retain that to operate.

Doctor PARSONS. I should also want in plant No. 2, if it could be obtained, the Claude nitrogen plant. It is not in the other plant.

The CHAIRMAN. Then, we would also sell the Waco quarry, would we not, and all of that machinery?

Doctor PARSONS. Yes, sir.

The CHAIRMAN. In the meantime, if we carried out the plan that everybody seems to want to carry out, we would have built Dam No. 3, and then we would have a whole lot more primary power—40,000—and a whole lot more secondary. What would you do with that?

Doctor PARSONS. Sell it.

Senator KEYES. Sell it to Mr. Ford?

Dr. PARSONS. Sell it to the highest bidder. If the Government is to do it it should sell it to the citizens around there—sell it to the man who would give the most money for it, and put it on short-time contracts, so that they will not have it indefinitely.

The CHAIRMAN. I am trying to get at a picture that will be true when the thing is completed and running and that Dam No. 2 is a part of the improvement that everybody contemplates eventually putting in, and we do not want to stop there.

Doctor PARSONS. If you would like to know what I think should be done——

The CHAIRMAN. That is what I want.

Doctor PARSONS. I have no hesitancy in giving it to you.

The CHAIRMAN. That is what I would like to have.

Doctor PARSONS. I think plant No. 2 should be kept in stand-by condition, until the possible emergency is past, as you suggested. I think plant No. 1 should be developed by private parties to whom the secondary horsepower is sold. I think when that is accomplished the Waco quarries should be sold to the highest bidder. I think the Warrior River extension of the Alabama Power Co. should be settled with the Alabama Power Co. under the contracts which have been made as a separate entity, so that the Government may carry out what I believe to be both its legal and moral obligations. That leaves you, then, simply the dams. Now, if you can get an offer that is good enough for the development of those dams under proper safeguards to the people, I believe in having those developed and operated by private parties, and they should go to the highest bidder. If you can not, I think the Government should go ahead and build them and sell the power itself, because I think that that immense natural resource of the South should be developed and used in some way.

The CHAIRMAN. Have you investigated the reservoir proposition? That is what I was leading up to.

Doctor PARSONS. I have not investigated it personally. It is not in my line of endeavor. I do not wish to give testimony on anything I do not think that I am perfectly qualified to speak on. I have, of course, followed all of the testimony which was given and have been very much interested in it, and I do not doubt that there is a very large water power, and that a distinct reserve of water can be developed on the Tennessee and its tributaries, but the details are for others, like Colonel Cooper, to speak of.

The CHAIRMAN. That would mean that the secondary power would be decreased and the primary power increased at whatever dams you might have them.

Doctor PARSONS. They would both be increased, but they would be increased by a greater proportion to the primary power.

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The CHAIRMAN. Now, Doctor, I wish you would——

Senator KENDRICK. Mr. Chairman, there is just one question I would like to ask before the doctor leaves that subject.

The CHAIRMAN. All right; go ahead, Senator.

Senator KENDRICK. I want to ask a question in connection with your statement that you thought this plant No. 2 should be kept in stand-by condition until the emergency had completely passed. Is it your opinion that the plants should be maintained with the same degree of efficiency standing idle as if they were kept in operation?

Doctor PARSONS. Yes, sir; this is a peculiar plant in that way, Senator Kendrick. It is a plant which is made up quite largely of materials which do not readily deteriorate; that is, it is brick and stone and cement and mortar and copper wire, copper leads, and it has these electric furnaces, the chief parts of which are made of fire brick. There is very little machinery that normally oxidizes in the air or that goes to pieces. This plant can be kept in stand-by condition for a very long time, especially that portion of it which you would have any thought of operating. It is quite possible that the ammonium nitrate plant would be a little more difficult to keep in shape, but even that could be kept in shape easily, because it is quite largely enameled ironware. The ammonium oxidation plant is largely brick and mortar. The ammonium oxidation plant has, in my opinion, already been superseded, and I do not think will be used long in any case, but so far as the cyanamid plant is concerned, the portion of it which will be operated for fertilizers could with very slight expense be kept in very excellent condition for a great number of years.

Senator KEYES. Did you not state something in your testimony about $100,000 being the sum necessary?

Doctor PARSONS. $100,000 or less, I think, is the actual experience of the Ordnance Department in the last year or two.

The CHAIRMAN. Doctor, let us go back again to where I was. You said something about the salaries provided for, and I suppose you were referring to the bill that I have introduced.

Doctor PARSONS. Yes, sir.

The CHAIRMAN. It was not my idea, Doctor, in providing that the salaries should be fixed at $7,500 annually, that we should employ chemists, or anything of that kind. Is it your idea, if that method were adopted, that the board ought to consist of men of that kind who are especially educated in scientific lines?

Doctor PARSONS. I think that on a board of three men, as you have it there, there should be at least one of them who is thoroughly technically educated along these lines, and that the others should be business men of vision and of successful experience. I do not believe you can get any such men, either the technical men or the business men, who would give up their time to a proposition of that kind for less than three or four times the salary per individual that you have provided for there. I know that any industrial corporation in a proposition of this kind would pick the best men that they could find in the country, and in order to get them, would pay those salaries, and I know that the best man is the cheapest, irrespective of what you pay him.

The CHAIRMAN. You may be entirely right about that, Doctor, and I do not want to criticize your position at all, because I think your position is the one that probably would be sustained by most people; but my idea was that on the board who would operate this proposition you would not necessarily have chemists or engineers. In fact, if I were selecting those men, I do not believe that I would select any one of them because of the fact that he was a chemist or an engineer, but I would select, rather, broad-minded business men, and they would employ such chemists and such engineers as they needed. For instance, if I were selecting them and I could get a man like Mr. Ford, I think I would pick him as one of the men to handle this great concern, although he is neither an engineer nor a chemist, and I believe that I would be competent myself to handle that thing, although I am only getting $7,500 a year, and I can not save nearly as much out of that salary as I could if I were handling that job.

Doctor PARSONS. I know, for I worked for the United States Government eight years of my life. You are doing it the same as I did, solely for the personal satisfaction of accomplishement.

The CHAIRMAN. Yes, sir; yes, sir.

Doctor PARSONS. Nothing else.

The CHAIRMAN. Now, could you not get those men and give them this life job?

Doctor PARSONS. No; that is a commercial business.

Senator NORBECK. The marble halls are missing; is that it?

Doctor PARSONS. Government service has both its advantages and disadvantages. It seems to me sometimes as if the men who were doing the best work in some of the departments are the ones who are blamed and received the most criticism.

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The CHAIRMAN. Yes; and lots of times it is the fellow who is getting the lowest salary who gets the blame.

Doctor PARSONS. Yes; take an investigation such as Colonel Joyce has had to go through with. There never was a more honorable, hard-working and straightforward man than he. It would have killed me to have gone through that, but he seems to have gotten through all right. I suppose these Army officers get used to being "bawled out" all the time.

The CHAIRMAN. They do not get bawled out half as much as Senators and Congressmen.

Senator NORBECK. But we can bawl back.

Doctor PARSONS. But the satisfaction of accomplishment is the only emolument that you can get from the Government service.

The CHAIRMAN. After all, speaking of the thing in a broad way, especially in a position that is going to last for life, the man who would take one of these positions for the dollars and cents that could be obtained as a rule would not, in my judgment, be as good as the man who would take it because he wants to accomplish something for his fellow men or for his country.

Doctor PARSONS. Well, I put in eight years of that kind of service. I was happy while I did it, but I had a family and I had to go out and make a living for them.

The CHAIRMAN. Well, Doctor, a man having this position down there would have a house to live in if he wanted to live down there, and he could support a family and do it well on $7,500 a year.

Doctor PARSONS. But that same man, the kind of man you ought to have, could lay up a competency for each one of his children, to start them out with afterwards. If you could find three bachelors or three married men with no children, it might be all right.

The CHAIRMAN. Another thing I have noticed in the various bills we have passed providing for salaries for things similar to this, there has grown up in Congress, especially in the Senate, a feeling—I have heard many Senators say so—that we should not vote for any salary for a member of a commission similar to this greater than the salary that the Members of Congress themselves were getting.

Doctor PARSONS. It is very difficult to get men of that kind appointed who are the best men for Government positions. Although you may put in all of the safeguards against politics that you choose, it is very difficult to actually accomplish the fact. I want to say this one thing, that if this plant is run by the Government you should follow the same methods as are followed by commercial organizations. Get the best man because he is the best man; get him because you have to have him to succeed; because he is the best man, and pay him what he is worth.

The CHAIRMAN. Is not that provided for in this measure?

Doctor PARSONS. Not a bit of it. You have tried to provide for it; the whole thought is through there, Senator Norris. I have no criticism to make; I have sympathy with your difficulties, but I do not believe——

The CHAIRMAN. The Government has difficulty in getting it out of politics; it is not its fault, I concede that, and I think that is the reason why so many people believe it will be a failure, because it is compared with government operations that have been a failure where politics had not been kept out. I would like to have suggestions from any source to improve it, with that in view, to keep it out of politics, if the thing can be done. Now, nobody charges that there is any politics in the Supreme Court of the United States.

Doctor PARSONS. No.

The CHAIRMAN. I have never heard of such a charge having been made by anyone

Doctor PARSONS. I do not think anybody makes that charge.

The CHAIRMAN. There have been other charges made against them, but I have never heard that charge made.

Doctor PARSONS. No.

The CHAIRMAN. And I have been desirous in this bill to surround this board in the same way that the Supreme Court is surrounded, by safeguards to keep it out of politics, and I think this board is even more safeguarded.

Doctor PARSONS. But the Supreme Court is the highest honor that can come to an American citizen outside of the Presidency of the United States.

The CHAIRMAN. It is a very high honor to be a member of this commission, according to my idea.

Doctor PARSONS. I doubt if it would be so regarded. There are plenty of commercial openings. There are plenty of commercial opportunities of a similar nature that are available, and most men find that they can do their best work in matters of that kind outside of the Government rather than in the Government.

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The CHAIRMAN. What do you think the salary should be, for the members of this board? Of course, if that item is not correct, that is something that I would be very glad to have remedied?

Doctor PARSONS. I do not believe you want a board of that kind, that is going to give up its time to it. I think you should have sepecially a president, and general manager and a board of directors. The board of directors would give just the same amount of time that ordinarily business men would give as directors. None of them give their full time to it. I think your president and general manager should be the best men possible to get, and they should be on a regular commercial basis. Their salaries should certainly be as high as $25,000.

The CHAIRMAN. For the members of the board?

Doctor PARSONS. No.

The CHAIRMAN. For the president and general manager

Doctor PARSONS. For the man who was the real controlling man. I am one of those who believe that if you can get the right man you do not need two other men to tell him how to run it. You simply need the other men to safeguard the situation, to see how it is run and look over it from time to time, like your board of directors.

Senator NORBECK. Would it not be better to have the board of directors select that man, and they would select the right man out of their experience?

Doctor PARSONS. Yes.

Senator NORBECK. I think so.

Doctor PARSONS. You are quite correct. That is what the board of directors should do, and they should be very careful in picking out the man who is to put it through.

The CHAIRMAN. Under this bill would they not have the right to select the general manager?

Doctor PARSONS. Why, they can select any officials they need, with the salary limited to $12,000.

The CHAIRMAN. Yes.

Doctor PARSONS. But a board of that kind should not be required to give up all of their time to it. They are not the men to direct it, but they will simply guard the direction of it by the man whom they appoint.

The CHAIRMAN. But in order to have this dream, as you might call it, come true, of utilizing completely the waterpower of the Tennessee River, the thought I had in mind was that these three men should supervise it and see just what should be done there and what could be done there and then select the necessary men who had the experience, to build it.

Doctor PARSONS. You are asking me a different question from what I had in mind. I do not know whether I care to pass upon it. I was talking about the nitrogen fixation situation.

The CHAIRMAN. That is only one of the questions I have in mind here.

Doctor PARSONS. So far as the nitrogen fixation situation is concerned, I think you ought to have a board which will have chiefly authority to hire and fire.

The CHAIRMAN. This board already has that authority.

Doctor PARSONS. And simply to sustain or not sustain the man who does have the direction of it.

The CHAIRMAN. My own idea was that this board should select some one man to take care of the nitrate proposition, some man to to take care of the engineering and look after the water proposition, etc., and another man of commercial experience to look after the profitable sale of the products; so I am of the opinion that these three men would be busy all the time, and if they are not busy all the time, if they do that work, I would want to keep them out of any other business, so that they may have their minds on this. As you know, Doctor, a man who may be working automatically here in this oom, who has his mind on something else a hundred miles away, is not doing good work here.

Doctor PARSONS. That is perfectly true.

The CHAIRMAN. If he is mixed up in a lot of private lines of business, he necessarily gives those lines of business his attention, and he thinks about them no matter where he is, as he ought to, and he would not be giving his best efforts to this corporation at Muscle Shoals. That is the reason I want to prevent his having any other business, so that he could get his mind and heart and soul into the work. Perhaps it is a serious mistake not to pay him more money.

Now, I want to ask you another question, Doctor. We have had something said here, and I think it was stated by Mr. Mayo, in regard to a process that you have not mentioned, the Casale process. Do you know anything about that?

Doctor PARSONS. Yes, sir.

The CHAIRMAN. Have you investigated that in any way?

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Doctor PARSONS. As much as one can without being told all about it by Casale. Did Mr. Mayo mention the Casale process?

The CHAIRMAN. Well, somebody did.

Doctor PARSONS. Or was it Mr. Worthington?

The CHAIRMAN. Yes, sir; it was Mr. Worthington. What is the Casale process?

Doctor PARSONS. You understand that what I say is on record and goes most everywhere, and I have to speak rather carefully about things of that kind.

There have been in practically all civilized countries a number of small inventors who have tried to make certain modifications for the fixation of nitrogen by the synthetic ammonia process. Casale is a chemist in the employ of the Idros Co. at Terni, Italy, who has simply been trying to find a different catalyst for the fixation of nitrogen and hydrogen, exactly the same as the Haber process. He has been trying to get a modification, and he has taken out one or two patents for a minor apparatus. The chief owner of the process, Mr. Lepreste, has been on this side trying to raise the necessary capital. He has had a chemist over there with him for the last two or three years. One or two friends of mine have gone over and investigated the property. I have talked with Lepreste and the chemists who have visited the property, and all I can say is that it is just like many other similar trials in various parts of the world, and nobody who has looked into it has put in any money, so far as I know. I certainly would not want to put a cent in it myself.

We have in this country a small operation of this kind by a nitrogen fixation company up at Providence which is able to fix nitrogen and hydrogen. In fact, anyone with a reasonable degree of intelligence at the present time, if you can give them pure nitrogen and pure hydrogen, will not have any great difficulty in rigging up a little plant that will fix a hundred pounds a day. I think Casale at present has not made more than a hundred kilos a day, while they have made two or three hundred at this plant up at Providence.

So far as this process is concerned, you can absolutely forget it. He has used the same thing Claude has used, electrolytic hydrogen, which is a waste product from a chlorine plant at Terni. Now, if you can get hydrogen for nothing as a waste product, of course your cost is going to be low, and when he gave these costs to these chemists, etc., he was getting his hydrogen for nothing. If you can given me hydrogen for nothing I will be a multimillionaire in a short time without any Government help. We have in this country, scattered throughout the country, several chlorine plants. At Niagara Falls there is enough hydrogen to make something like 10 tons of ammonia per day. It is a by-product that until recently has been going to waste. In the production of hydrochloric acid one plant at Wyandotte, Mich., at the present time, when fully operating, makes enough hydrogen to make 5 or 6 tons of ammonia per day. Of course, they have that waste from the chlorine production. It is not possible to use it. If you want to go further and get more production you can not sell your chief products—chlorine and caustic soda. As long as anybody has the by-product to throw away, as they have in several places—such as at Terni, Italy, and as at one or two places in Switzerland—they can make ammonia on a small scale. But that is just a bagatelle.

The CHAIRMAN. Is it not possible to develop this process so that they can manufacture it on a large scale?

Doctor PARSONS. This process has no essential difference. All of these processes that I have spoken of are modifications of the Haber process. So is the Casale process. The Claude process, another, is much better. Claude is one of the best engineers in the world. He has developed pressure apparatus that no one else has been able to develop. The General Chemical Co.'s method is far superior. As far as Casale is concerned I do not think any commercial company at the present time is seriously considering putting in his process on a large scale. It is the Haber process eventually; it is nothing in the world but the Haber process modified with certain apparatus which Casale has been working on.

Senator HEFLIN. You know, it frequently happens that when a man discovers a new process those who have the old processes fight him.

Doctor PARSONS. But this is not a new process.

Senator HEFLIN. Unless they can get hold of the new process themselves.

Doctor PARSONS. But this is not a new process.

Senator HEFLIN. They do not like to have him bring in a new process, because they would have to do it with their old process or put his into use.

Doctor PARSONS. This is not a new process. I think I am in touch with pretty nearly all of the developments that have been or are being made in the world to-day in fixing nitrogen. I have made several trips to Europe, and they have offered to take me through that plant any time I came to Terni, but I have not yet been to see it.

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Senator HEFLIN. You know, when the Wright brothers started to make an airplane heavier than air fly with a couple of men in it they were laughed at. But I saw them when they broke the world's record out here at Fort Meyer and were in the air for an hour and 20 minutes.

Doctor PARSONS. That was a different situation there. Merely a change in the propeller of an airplane.

Senator HEFLIN. Is it not a fact, Doctor, that in this realm nobody knows what will be accomplished or what can be accomplished?

Doctor PARSONS. I have said that I would not deny anything in the way of possibilities.

Senator HEFLIN. You know, in the old days, when they treated diphtheria by giving medicine and putting poultices on the throat of the child or whoever was afflicted with the disease, they could not cure the disease, the patient would choke to death; but finally a man invented a serum, and he said that if they would permit him to inject that serum into the blood that he would cure the disease. All of the old doctors said he was crazy and they did not want to use it, but the father and mother of the child consented when he told them that he could not save the child under his old process, and he used his serum and he saved the child. Now, millions of children are being saved by that serum. I think we have the same situation in regard to fixing nitrogen, that all of the processes that we have now will be improved, and fertilizers will be made much more cheaply. If such is not the case, then the farmers are in a helpless situation.

Doctor PARSONS. I believe so, and I hope they will be improved, and I am thoroughly in favor of carrying on researches in nitrogen fixation, but while doing it I think it should be done intelligently, and I do not think every fly-by-night scheme should be accepted immediately as having successful prospects.

Senator HEFLIN. If Mr. Ford is willing to invest his money in the project at Muscle Shoals and contracts with the Government that he is willing to do it, and this is only his offer stating what he is willing to do, the contract has not yet been written, and when it is we can put a clause in there bringing him specifically to produce commercial fertilizers at Muscle Shoals. He does not say that that is all he will do there. Perhaps he will use some of that power for other purposes, but if he is willing to spend his money and go into the matter of making fertilizer at Muscle Shoals, does it not show that he thinks he has a process by which he can compete with those who make commercial fertilizers?

Doctor PARSONS. I do not think it shows anything of the kind. I think it shows he wants the water power there, and he is using cheap fertilizer as the means of getting it.

You will be giving him a tremendous advantage, and there are many people or corporations in the United States, equally financially responsible, with Mr. Ford, who, if they had the opportunity, would jump at it as quickly as a trout to the fly in spring streams.

Senator HEFLIN. But the fact that he is willing to go there and undertake this and bind himself to do this would indicate that he has got a secret process, as I understand he claims to have, by which he can make fertilizer for half the price that it is being made at to-day, for the benefit of the farmer.

Doctor PARSONS. I have never yet seen anything that would indicate that he is willing to bind himself to make 2,000,000 tons of fertilizer per year, as Mr. Mayo states there, and if he is prepared to make 2,000,000 tons of mixed fertilizer per year and reduce the price one-half, using Muscle Shoals for that purpose, I have no objection to giving it to Ford, because I think there is no other man in America who will do it, but I do not think you can get that contract out of Ford or anybody else.

Senator HEFLIN. Well, if he is willing to sign the contract after we accept his offer, and if he is prepared to contract to do what he says in his offer he will do, then the Government will not be to blame for his failure to accept it; but here is the proposition as I see it now: We are going to accept the Ford offer or nothing. That project is going to lie there, in my judgment, and I think there are a good many power companies and fertilizer companies who would be glad to see the Government let it stand there undeveloped for a period, and then later on to buy it just for a song. I think that is the situation.

Senator KEYES. Ford is not paying anything for it, is he?

Senator HEFLIN. Well, probably not as much as we would actually get for it, but what he has offered there, it seems to me, is the best offer in sight. I would like to see the best business transaction possible for the Government, so far as that is concerned, but the way it occurs to me is that we are up against a proposition here, laid down by a man of wonderful genius, a man who has made a marvelous success in the world himself, and he says that there are great possibilities at Muscle Shoals, that he can take the water power there and can harness that water power and produce fertilizers

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very cheaply; that he proposes to build an industrial city there, that he will spend a great deal of money in doing it, and if he does that, that would benefit many thousands of people, and if he can produce the fertilizers at half the cost, as he thinks he can, it would be a great blessing to thousands of American farmers.

Doctor PARSONS. I do not deny that if you can get a fertilizer for half price, it would be a great blessing, but I do not believe there is any committee in Congress or Congress itself that would consider the Ford offer from any other man than Ford for five minutes.

Senator HEFLIN. You do not believe they would consider it?

Doctor PARSONS. No; not from any other man but Ford, and I can not conceive how they would even consider it from Ford.

Senator HEFLIN. But do you not think that his offer is the best offer we have now?

Doctor PARSONS. No, sir.

Senator HEFLIN. You do not think it is as good an offer as yours?

Doctor PARSONS. My offer has nothing to do with the Muscle Shoals, especially.

Senator HEFLIN. Yes.

Doctor PARSONS. I can not compare them. I think the Alabama Power Co.'s offer, although I have no interest in the Alabama Power Co., is far superior to Ford's offer.

Senator HEFLIN. You do?

Doctor PARSONS. Yes, sir. They offer to build the dam and give you 100,000 horsepower for nothing. I will give you some figures on that which I think ought to be before you. The Alabama Power Co.'s offer is to build the dam without the expenditure of a cent, as I understand it, on the part of the Government, and to give you 100,000 horsepower of secondary power for nothing. If the secondary horsepower is sold by you for three-quarters of a mill per kilowatt hour, which is the price that everybody has used to base their estimates on in their operation there, you would get $657,000 cash per year. If you take that $657,000 cash per year, to be paid one-half semiannually, and put it out at compound interest for 94 years, as Mr. Ford proposed to do with the $40,000 which he is to pay in as an amortization sinking fund, that $657,000 at the end of 94 years would amount to $676,572,030, while the other amount which Mr. Ford is to pay in would amount to only approximately $40,000,000. If you take that at 5 per cent interest, at the end of 94 years, and these payments are absolutely parallel, because they are cash payments, at a definite time, it would amount to over $1,200,000,000.

Now, I do not want you to think for a moment that I am assuming that the United States Government is going to take its money and put it out at compound interest at 4 per cent for 94 years, whether it comes from Mr. Ford or from the sale of power with the Alabama Power Co., but I say these figures are absolutely comparable, and you should take them into consideration.

The CHAIRMAN. It is about 1 o'clock now. Have you anything further to state, Doctor?

Doctor PARSONS. No, sir; unless you wish to ask some further questions.

The CHAIRMAN. There is no witness for this afternoon, so we will adjourn until to-morrow morning at 10.30 o'clock.

(Whereupon, at 1 o'clock p. m., the committee adjourned until to-morrow, Tuesday, May 9, 1922, at 10.30 o'clock a. m.)

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MUSCLE SHOALS.

TUESDAY, MAY 9, 1922.

UNITED STATES SENATE,
COMMITTEE ON AGRICULTURE AND FORESTRY,
Washington, D. C.

The committee met, pursuant to adjournment, at 10.30 o'clock a. m. in the hearing room of the Committee on Commerce, United States Capitol, Senator George W. Norris presiding.

Present: Senators Norris (chairman), McKinley, Capper, Keyes, Ladd, Norbeck, Harreld, Kendrick, Harrison, Heflin, and Caraway.

The CHAIRMAN. The committee will come to order, and we will hear Mr. McClellan.

STATEMENT OF MR. WILLIAM McCLELLAND, PRESIDENT OF McCLELLAN & JUNKERSFELD (INC.), ENGINEERS AND CONSTRUCTORS, NEW YORK CITY; ALSO PRESIDENT AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS, AND MEMBER EXECUTIVE BOARD OF THE AMERICAN ENGINEERING COUNCIL.

Mr. MCCLELLAN. I am William McClellan, president of McClellan & Junkersfeld (Inc.), an engineering and construction organization in New York City; president of the American Institute of Electrical Engineers, and member of the executive board of the American Engineering Council, which, perhaps, it is well to say, is the executive body of the Federated American Engineering Societies, including all of the great engineering societies of the country.

The CHAIRMAN. How old are you, Mr. McClellan?

Mr. MCCLELLAN. I am 49.

The CHAIRMAN. For the record, I wish you would tell us where you were educate and what business you have been engaged in since you have been out of school up t the present time.

Mr. MCCLELLAN. I was educated at the University of Pennsylvania, with the degrees of Bachelor of Science, Doctor of Philosophy, and Electric Engineer. I was engineer in charge of construction for the Philadelphia Rapid Transit Co. Later I was one of the managing engineers of Westinghouse, Church, Kerr & Co. Later on I was chief engineer, and also chief of the division of light, heat, and power of the Upstate Public Service Commission of New York, and since 1907 I have been in the general business of consulting engineer, first as McClellan & Campion, and later in construction engineering work with Colonel Junkersfeld, under the name of McClellan & Junkersfeld, doing all sorts of engineering construction work. For a time I served the University of Pennsylvania as dean of the Wharton School of Finance and Commerce.

The CHAIRMAN. And what particular work are you doing now, Mr. McClellan?

Mr. MCCLELLAN. Just at present the largest piece of work we have, in addition to a lot of report work, is the building of a large steam power house on the Mississippi River for the Union Electric Light & Power Co. of St. Louis. We are also very much interested in several railroad electrification projects and work of that sort. Our business is large construction work.

The CHAIRMAN. Have you made a study of the Muscle Shoals proposition?

Mr. MCCLELLAN. No, sir; I have not made a technical study of the Muscle Shoals proposition, and I have not come here this morning to talk of any of the technical features, but if I may go on——

The CHAIRMAN. Yes; we will be very glad to have you go on in your own way now and give us all the information you have.

Mr. MCCLELLAN. Yes. As president of the Institute of Electrical Engineers and member of the American Engineering Council, the question of Muscle Shoals has been a subject of active discussion many times. I have also had other opportunities for talking it over with prominent engineers and business men of the country, not

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only when it was active as a war project but also since the problem has come up as to what to do with it, now that the immediate war needs are past.

I suppose it will be understood that the busiest, most active, and in many respects the most competent engineers of the country would not take up a study of Muscle Shoals unless they were called upon to do it for some special reason more or less in connection with their own business. I find that to be true. I myself know very little of Muscle Shoals except from the reports that I have seen of it in the newspapers and reports of these hearings and other discussions.

The CHAIRMAN. Have you studied the various bids that have been made in regard to it?

Mr. MCCLELLAN. I have merely read them, but I have not studied them in detail and I come here this morning not so much to discuss those bids as to suggest to the committee what my general observation and experience would lead me to believe was probably the best thing that you could do under the circumstances. I believe that your committees—this committee and the House committee—have probably had before you a huge amount of information on this project, much of which is ex parte, not by any means dishonest because it is ex parte, but it is ex parte. It is looked at from the general standpoint of someone who wants to do something, and that purpose may be the most honest purpose in the world. I am not challenging that at all. Nevertheless, I think that the Government of the United States has not had it looked at yet solely from its own interest, unless you put the work of the Army Engineers in that class; but I must go on to say that even then this project is not a technical engineering project. In my opinion it is a business and commercial project at first.

Now, I grant you that the United States Army has in its engineering branches probably as able engineers as you will find in the civil ranks, but this being largely a business and commercial proposition, it can only be decided, I think, by men who have had wide business experience. For that reason, it seems to me, that we must approach it from a little different angle.

My proposition is, first of all, that this committee, either your own alone or in connection with the House committee, should invite a group, say, of five engineers, carefully selected not only because of technical experience they have had, but because of business experience they have had, to review this proposition, and recommend to this committee or these committees the ultimate disposition which should be made of Muscle Shoals.

Now, this is not a new proposition that the Government faces, except as a Government matter. The large corporations of the country have very frequently bought properties, they have merged those properties, costing millions of dollars, and the boards of directors and their officers have been faced with the necessity of making a decision as to whether some of those properties should be rehabilitated and made more efficient, or whether they should be scrapped; and it is not an uncommon thing for a private corporation to decide to scrap a valuable plant, to use it no longer, in the interest of economy.

In the same way here I concede that there are a half a dozen different solutions which might be proper in this case. In fact a great many of them have been proposed. It is conceivable that the Government should take the position that it be paid for what has been done there, in whole or in part, and thereafter have no further relation to it. It is conceivable that the Government should go on and spend money up to a certain point on some definitely decided upon plan as to where it should stop. It is conceivable that the Government should finish it completely and rent it. There are lots of dispositions that could be made of it.

It seems to me it is not only a technical matter, but it is largely a business matter, and so I make that recommendation very strongly to this committee.

Now, I am not asking the Government to appoint a salaried commission to work out the Muscle Shoals project at all. I am proposing that the Government invite a group of engineers in this country to make a general proposal as to what should be done, not to do any technical designing or anything of that sort, but take the matter that is already in existence, review it and suggest to the Government the best business basis on which this project could be worked out. After that time, have the problem put up to the Army engineers, the Government engineers, or a private group of engineers, or what not, to work out the actual design and detail of it.

I will personally engage now, if this committee should issue such an invitation, either as president of the American Institute, or as member of the American Engineering Council, to offer to this committee a group of men who would serve without pay for their time. I mean merely to review the evidence and to suggest to this committee the very best disposition which could be made of Muscle Shoals. That group of men, as I have said before, would have to be men of technical attainment and also of business experience, men who are rushed in their profession and who are so busy

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at other things to start in to study this project with no purpose whatever, except, perhaps, to be informed in regard to it. They are men who, of course, if asked to do it for private interests, would only do it for pay. They are men, however, that I am quite sure, on the invitation of the United States Government, would be very glad to do this preliminary thrashing out and make recommendations.

Of course, if that plan is accepted the problem is not solved. The question then comes up as to what is to be done in the meantime, and that presents some very serious problems. I can only speak of that generally, because I have not visited Muscle Shoals, and therefore I am not in a position to speak of it in detail; nor have I studied in great detail the costs of the various plans. But I do know that a large amount of money has been spent there. I do know that it is possible that it could deteriorate, and the first thing that would occur to me is to follow the usual plan of commercial corporations, that when work is interrupted for any reason, they spend whatever money is necessary to protect that work and to keep it from deteriorating.

A further proposition has been made—I have seen it in the papers, I think—that the Government go ahead and spend some millions of dollars to make it rentable. That is the expression that has been used, to sort of, so to speak, finish a certain portion of the project, so that those interested in using it would find it, to use the analogy of a house, put in good order.

My only answer to that is that I think it is a very reasonable proposition in many ways, and to use again the analogy of a house which is to be rented, we all know that if one owns a house down here in the Avenue, and he wants to rent it, it had better be put in a presentable condition. That is true. Perhaps it ought to be renovated as a dwelling; perhaps the front ought to be torn out and the building turned into a store, or perhaps it is not worth spending money on it.

Therefore, I still contend that before we spend money to make a thing rentable unless it is absolutely necessary to keep it from deteriorating, we had far better find out whether the thing is rentable, whether after we have spent the money it really is a project which would be taken up.

Now, let me say that so far as my own fundamental position is concerned, I believe the Government of the United States can very well afford to make streams like this navigable, if competent authority decides that it is advisable. It can very well afford to spend the money on many streams which have power on them in making them flow more uniformly by putting pondage at the heads of the waters, and things of that sort. I am not at all opposed to that. I think there is a great deal of work of that sort that can be done. I have always been opposed to the Government going into the commercial side of the matter, but that is another question that is not under discussion here. So that primarily I am not disposed to stand in the way of spending from seven to ten million dollars to complete any dam or anything of that sort to make it more rentable. I am only raising the question that unless it is absolutely necessary to do that at once, unless there is something about the proposition which makes it rather peremptory, then I think we could very well afford to first find out what is going to be done with the thing afterwards before that money is spent. Secondly, in regard to nitrate plants, that is another question that comes up pending the final decision of what is to be done with Muscle Shoals.

Frankly, I do not think the Government ought to, under any circumstances, alienate these nitrate plants until it has some better project for nitrate plants. In other words, those plants should be held. If necessary, they should be completed, and if this committee of engineers and business men that I am talking about were to agree with that is the best place in the country to have nitrate plants, that that is the advisable place for the Government to have its nitrate plants that it can call on for protection in time of war, then I think those should be completed. But, in my opinion, I do not think they should be alienated. I do not think we ought to let go of them until we are assured that we have no other use for them, and that we are going to have nitrate plants somewhere else.

The CHAIRMAN. Now, Mr. McClellan——

Mr. MCCLELLAN. That, in brief, is my general position.

The CHAIRMAN. First, I want to ask you a few questions about the immediate thing, whether we ought to spend any money and go on with the work of the dam or not. The Government has two nitrate plants there, as you know.

Mr. MCCLELLAN. Yes.

The CHAIRMAN. Both of them completed.

Mr. MCCLELLAN. Yes.

The CHAIRMAN. One of them, however, the small one, nitrate plant No. 1, will have to be remodeled.

Mr. MCCLELLAN. Yes.

The CHAIRMAN. That is a small plant as compared to the other one?

Mr. MCCLELLAN. Yes.

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The CHAIRMAN. And there is no reason why the Government should commence to rehabilitate that plant to-morrow or next year or any other time; it is in good shape.

Mr. MCCLELLAN. My proposition is we should not let go of anything—that we ought to hold tight to it.

The CHAIRMAN. Plant No. 2 is complete in every way and the Government could commence to make nitrates there to-morrow, because it has steam power sufficient to run it.

Mr. MCCLELLAN. Yes.

The CHAIRMAN. It is very expensive, however, to run it, particularly by steam, but it is not the object of the Government to build a dam that we have spent $17,000,000 on to operate plant No. 2. The expenditure of that amount of money, of $17,000,000, was for the necessary preliminary work and surveys and the actual putting in of the dam. One-third or one-fourth of it, probably, is in.

Mr. MCCLELLAN. Yes.

The CHAIRMAN. In connection with it, we have a railway bridge clear across the river, and have cofferdams. There is one cofferdam around there preparatory to building another part of the dam that covers 13 acres. None of that work is permanent work.

Mr. MCCLELLAN. No.

The CHAIRMAN. Now, the danger is, as our engineers tell us, and I think it is apparent to any ordinary observer, that that work is liable to be all lost unless we utilize it before it deteriorates to such an extent that it can not be used. Now, the question immediately before us, and it is one that you have been discussing somewhat, is whether we ought to go ahead with the dam and appropriate $7,500,000, that being the amount estimated it would take to carry on the work for another year, or whether we ought to wait, as you suggest, until this committee that we might select would determine whether that should be done. In the meantime, before that committee gets around and makes its report, perhaps all of this work would go out and several millions of dollars would be lost absolutely, and if we decide afterwards to build the dam it would all have to be put in again.

Is it your judgment, as an engineer, that we ought to stop right where we are before we go any further with it?

Mr. MCCLELLAN. No, sir; that might very well come under the head of protecting money already spent, but if I were assured of the competency of my advice—and I have no reason to doubt it, sir, and do not think for a moment that I am doubting it—but if you were assured of your advice, then I would place it in the category of doing those things which are necessary to prevent existing works from further depreciation.

The CHAIRMAN. So far as I know, no engineer or other person, at least within the last six months, has gone on the ground and examined this work but what he has agreed that the dam is all right, so far as it has been done, and that it should be completed. It is part of the Government's plan, in fact, to operate nitrate plant No. 2.

Mr. MCCLELLAN. Yes.

The CHAIRMAN. Unless some new discovery is made. A great deal of the evidence before us shows that nitrate plant No. 2 can not be operated, even with this power, in a way to make fertilizer any cheaper than it is being made. There is some disagreement of opinion on that; but, regardless of that, as a war measure, to be ready in case of an emergency, should we not operate plant No. 2?

Senator HARRISON. And originally it was considered as a navigation proposition.

The CHAIRMAN. Yes; I thank you for that suggestion, Senator.

Senator HEFLIN. And without it the river would not be navigable.

The CHAIRMAN. Partially so; yes. As the dam stands now navigation is absolutely prohibited; you can not go up or down the river.

Mr. MCCLELLAN. On the basis of your statement right now, Senator, I should say without any question, without having seen it, but in view of the fact that you say that every engineer who has looked at it, and I know that competent engineers have been before this committee——

The CHAIRMAN. That is the point I wanted to make clear.

Mr. MCCLELLAN. Therefore, I place that under the category of those things necessary to keep it from deteriorating, and while $7,500,000 is a large sum of money, we must deal with it relatively. A private corporation, for example, might spend $7,500 to protect its interests, and that to them might be just as large a sum as $7,500,000 would be to the Government.

The CHAIRMAN. Of course, it is conceded that $7,500,000 will not complete the dam. It will take about $22,000,000 or $23,000,000 to complete it.

Mr. MCCLELLAN. I would still stick to my principle, that the money ought to be spent, whether $7,500 or $7,500,000. I stand on the principle of not allowing further

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depreciation in any way, shape, or form until the ultimate decision is reached. That is where I stand. You may be quite justified in spending the $7,500,000.

Senator McKINLEY. Mr. McClellan, is this the proposition that is in your mind, that the Government having spent in the neighborhood of $100,000,000 there——

Mr. McCLELLAN. Yes.

Senator McKINLEY. It is your idea in all of this testimony that you have been giving the committee that, as $100,000,000 has been spent, we ought to have the advice of disinterested engineers, taking the proposition as a whole, as to what we should do?

Mr. McCLELLAN. Ultimately. Whether it costs $7,000,000 or $75,000 or $750,000 or $7,500,000, I do not think it should be allowed to deteriorate, but if that will not complete it, that does not interest me. Of course, so far as I know just at present, that is, for six months of the year, the Government does not make nitrate. I confess that we might like to have that plant or to know that it was there, but I do not believe we ought to part with it, or get rid of anything that is there.

The CHAIRMAN. Of course, we ought to say to you, Mr. McClellan, that as a matter of fact, we do have the power to operate plant No. 2 to its fullest capacity—steam power.

Mr. McCLELLAN. Yes.

The CHAIRMAN. But that is very expensive.

Mr. McCLELLAN. That is very expensive, but, as a war measure, that is of no moment.

The CHAIRMAN. No.

Mr. McCLELLAN. As a war measure that is of no moment whatever.

The CHAIRMAN. The construction of the dam would assist very materially in cheapening the product in time of war, of course.

Mr. McCLELLAN. Exactly.

The CHAIRMAN. And would possibly assist, to a great extent, in solving the fertilizer question.

Mr. McCLELLAN. It might.

The CHAIRMAN. Which Congress had in view as one of the objects when it passed the act under which the President located these works at Muscle Shoals.

Mr. McCLELLAN. But of course you can do it, and in time of war you could get along to the extent of the capacity of that plant. It seems to me, then, that I am sound in my principle, that irrespective of what it costs, within any degree of reason, the plant should not be allowed to deteriorate under any circumstances—that the money ought to be spent. That is the general view that you ought to take in deciding whether the $7,500,000 ought to be spent.

Let me say there that it is not my opinion that this group of business engineers or engineering business men—and I want to bring that out in the record—would not undertake it for the purpose of designing at all, but, from the standpoint of the United States Government it is my opinion that they would not take years to work this thing out.

The CHAIRMAN. It would be interesting to know about what time you think it would take.

Mr. McCLELLAN. Well, sir, the type of engineers that I have in mind are busy at large projects, and would come into it and take evidence of all sorts, but they would not put a staff in the field and would not make an independent investigation, and I should think that from three to six months would be ample in which to advise this committee.

The CHAIRMAN. And that committee, Mr. McClellan, as I understand it, would take all of the evidence before these two committees?

Mr. McCLELLAN. Yes, sir.

The CHAIRMAN. And I suppose they would visit the place and would look over the situation?

Mr. McCLELLAN. Oh, there is no question about that, so that they could orient themselves, so that each one of them would be acquainted with the project.

The CHAIRMAN. Yes.

Mr. McCLELLAN. But I take it that they would not be required to have the statistical work done or anything of that sort. They would not be paid for their time at all, but the statistical work and work of that kind would really be done by the committees of Congress, and the expense of anything of that sort, of course, would be assumed by the committees here. These men would merely devote their time to it without compensation. That is my view of it.

I say to you frankly that in my official position I would engage to suggest to you men who I know would be willing to do that sort of thing, and men whose standing and integrity would be beyond question—the same type of men as the great lawyers in this country who have taken the Government for their client, and these men, so to speak, would take the Government for their client.

The CHAIRMAN. Senator Kendrick, do you want to inquire of the witness?

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Senator KENDRICK. I think not, Mr. Chairman, except that I thought I would ask Mr. McClellan if he did not think that in deciding the question as to whether we should continue the construction of the dam that, in addition to the possibility of its use and the benefits to be derived from its use we might very well consider the money already invested that would be sacrificed, that not only the present use of the money invested would be lost, but, perhaps, in addition the deterioration of the work already done, so that the amount actually invested in construction up to this time might be one of the determining factors as to whether we should go ahead.

Mr. McCLELLAN. Right now?

Senator KENDRICK. Yes.

Mr. McCLELLAN. Oh, no; not unless you are sure that you are not going to get deeper into a hole by going ahead.

Senator KENDRICK. Well, we could not very well get deeper if we proceeded to finish a dam that is clearly in the interest of sound business principles.

Mr. McCLELLAN. Oh, exactly, if it is clearly in the interest of sound business principles, then I think we should go right ahead and finish it.

Senator KENDRICK. It is in line with our whole policy of water-power conservation.

Mr. McCLELLAN. Well, you mean by that, sir, that you are ready to go ahead with another project right off and keep this thing going on?

Senator KENDRICK. Not necessarily, but this has a direct bearing on the service to the Government. It is a little different from the other.

Mr. McCLELLAN. No.

Senator KENDRICK. We need it, as the chairman has pointed out, in the manufacture of nitrates in case of war.

Mr. McCLELLAN. Oh, yes; but in commercial practice—for example, in my own work—one of the most serious problems that I have to decide very frequently in connection with a power house is as to whether it will be an expensive power house to operate or a cheap power house to operate. Very frequently we frankly build a power house which is expensive to operate, because unless you are going to use the power house enough so that the saving in operation is going to make up for the difference in capital cost it pays sometimes not to put in an expensive operation simply because you do not get enough use out of it.

Supposing that we knew—of course we do not know—but supposing we knew we were going to have a war once every hundred years; it might pay us to say, "Well, we will use the steam plant for war purposes, even if it is rather expensive, rather than to have millions and millions of dollars tied up there for a hundred years on which to pay the interest."

Senator KENDRICK. Your statement is based on the assumption that there would be no other use for the power than that which the Government had in serving its own purposes, but there is a demand, apparently, now for practically every bit of power in that country; so that the Government would not find it necessary to allow this power plant to stand idle. There is no reason to believe that is true.

Mr. McCLELLAN. If your information is entirely correct, sir, of course there is very little to be said about the proposition, very little; but I had gotten the impression from newspaper accounts of the hearings before this committee that there was grave doubt as to whether that was a commercial proposition or not.

Senator KENDRICK. I do not think there is any doubt of it, and I do not believe any other member of the committee who has been down there believes that there is.

Mr. McCLELLAN. The impression throughout the country is that this is not a commercial proposition, that there is no market near there.

Senator KENDRICK. Is it not almost an assured fact, if the power is there at a moderate cost, that there would be industries to go there from different sections of the country to employ that power?

Mr. McCLELLAN. I am not sure of that, sir. I do not know. Do not think for a moment that I am denying it. I am not; I do not know. I know that it takes a very long time to build up a market, and if the market has to be built up in that form, we do not regard that as a commercial proposition. I should say that there are water powers in this country far better than Muscle Shoals, from my general information only.

Senator HEFLIN. Where are they located?

Mr. McCLELLAN. In the Rocky Mountains and elsewhere; but they have to have a market brought to them; but if you are going to go on the principle that you can bring the market to them, I think there are lots of them.

Senator HEFLIN. We have been told that there is none other in the country better than this except at Niagara Falls.

Mr. McCLELLAN. I really can not enter into that discussion, Senator, because I do not know. Take one that is under discussion right now, the St. Lawrence River

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power. Nobody denies that there is a huge water power there, but the great problem, of course, is the market. In fact, there are those who favor it as a navigation project and there are those who favor it as a power project. The navigation people say "If you wait until the market develops it will be 20 years before we get the navigation facilities." But I am not denying it, sir. I am simply answering the general proposition that until you are sure of that it would be very unwise to either give it to anybody or to rent it to anybody.

Senator NORBECK. Is that two or three?

Mr. MCCLELLAN. The whole thing, whatever is down there. The same principle applies to all of it.

Senator NORBECK. We are at a considerable expense on plant No. 2.

Mr. MCCLELLAN. Yes.

Senator NORBECK. Because it is partly constructed.

Mr. MCCLELLAN. In other words, I would rather see this committee reserve its decision for six months or even a year, and in the meantime spend whatever is necessary to protect the works and make a right decision, with the help of competent advice.

Senator NORBECK. There can be no other decision than to complete the dam, according to present plans, can there, at No. 2?

Mr. MCCLELLAN. No; there can not be any other decision.

Senator NORBECK. We would make no serious mistake if we should go ahead and complete that dam which is now under construction there?

Mr. MCCLELLAN. I suppose not. That is assuming that it is not going to cost very much more than what you say it is going to cost to complete it. It depends on what it is going to cost. I know this, that if it costs $50,000,000 to complete it, and it stands there complete, you would have added $50,000,000 to your burden, unless you were going to use it. Somebody, after they had studied the thing out, might say, "Well, after all, this really is not the place for a nitrate plant, anyway."

Senator KENDRICK. Well, assuming that it was not a place for a nitrate plant, is it not your opinion——

Mr. MCCLELLAN. Then, you might find that you had spent all of that money and you had to go to some other place and spend some more.

The CHAIRMAN. I think it is conceded that, so far as the nitrate matter is concerned, there will be great improvements and inventions which may make it necessary to scrap every bit of the nitrate machinery that we have there, and we will all be glad to scrap it.

Mr. MCCLELLAN. Yes.

The CHAIRMAN. If the method is so improved that we can manufacture it more cheaply, but as the situation is now we have not anything except nitrate plant No. 2.

Mr. MCCLELLAN. With the steam plant.

The CHAIRMAN. With the steam plant, to make the nitrates for our supply in case of war.

Mr. MCCLELLAN. Yes.

The CHAIRMAN. If we should be cut off from Chile.

Mr. MCCLELLAN. From the standpoint of war requirements you could start up the steam plant and go ahead and make it.

The CHAIRMAN. Yes; we might go ahead to-morrow.

Mr. MCCLELLAN. Then, that removes any necessity for an immediate decision.

The CHAIRMAN. Except for the fact, I think, that we have the dam one-third completed.

Mr. MCCLELLAN. Yes.

The CHAIRMAN. If you assume that what I have said to you is correct, assuming that I have told you the truth about it and have gotten it right in my statement to you, there would not be any doubt in your own mind that we ought to appropriate $7,500,000 to complete that dam?

Mr. MCCLELLAN. There would be no doubt at all, but I still go back to my point——

The CHAIRMAN. Of course, if we get Dam No. 2 completed, there is no stopping then.

Mr. MCCLELLAN. But you said a few moments ago that the $7,500,000 would not complete it.

The CHAIRMAN. No, sir; that is one-third of it.

Mr. MCCLELLAN. So I would really stick to my principle that instead of spending the $7,500,000 you ought to proceed with the idea of protecting things and holding it so that there will be no further loss pending this ultimate decision as to what you are going to do with the whole grand project.

Senator NORBECK. One of the surprising developments to me has been that the nitrate problem seems to be not so directly connected with the water-power problem.

Mr. MCCLELLAN. It is not.

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Senator NORBECK. That cheap nitrate and cheap water power do not necessarily mean cheap fertilizers.

Mr. MCCLELLAN. No, sir; I do not think it does.

The CHAIRMAN. If the dream of the scientists comes true that, through the Haber process, so far as the production of nitrates from the air is concerned, the problem is to a great extent eliminated, it would be only incidental and we could locate a nitrate plant anywhere that it was safe from attack.

Mr. MCCLELLAN. There is one aspect of this question, gentlemen, of course, that is very serious, and that is that the Governm ent, as you know, struggled for years with the water-power bill. People on the outside and the officers of the Government, as well as Members of Congress, wnated to know some things in an attempt to protect the Government, and a conclusion was finally arrived at in the water-power bill.

Now, this country is unquestionably going on a basis where power is going to be one of the most serious things that it has to consider. We have got to compete with the rest of the world as we have never had to compete before. There is no question of that, particularly in foreign trade, and we are meeting that competition right here in this country. We have to cut our transportation costs some how or other. We can not continue under present conditions, and we have to cut our transportation costs very seriously somehow or other. We have to be in a position to deliver our grain in Liverpool at a less cost, or else to ship out our cattle, either one or the other. We also have to compete with the low scale of living in almost every other part of the world. We do not want to lower the scale of living in this country, and that means that we have to put machines in our factories to enable a man here to produce three or four times as much as a man in the foreign countries can produce. Otherwise we will not be able to compete.

Now, all of these things require power. Power is the very bottom of it all, and therefore this country has got to improve on power development as it has never before been done.

In this great proposition that we have at Muscle Shoals, now that the Government is in it, it is of extreme importance that no mistake be made there. That is another side of the matter, and the moral effect of a mistake made right here is going to be very serious on other power developments in this country, and I do not hesitate to say that it may set back water-power development a great deal if a mistake is made here. That is the reason I came down here this morning.

Senator NORBECK. Like that of the Government railroad in Alaska?

Mr. MCCLELLAN. Absolutely. Mistakes of that sort react seriously, and we can not afford to make a mistake here in the grand solution of the problem. For that reason we have to be very careful as to just what is done and how it is done.

Senator KENDRICK. On what point are you anxious? Are you disturbed lest if we build this power plant, finish this dam, and develop a great power plant there, we would not find a market for it; is that it?

Mr. MCCLELLAN. Partly that.

Senator KENDRICK. And is it because you think that we may build the dam according to wrong principles of engineering?

Mr. MCCLELLAN. I am not a bit afraid of that; no. I am quite confident that the technical part of this work will be done and done well by the men who have been connected with it, the men the Government are likely to bring into it, or any other persons who might be brought into it; but I do know that railroads have been built in this country in the past where men have been absolutely convinced about a rosy future, and reports came out year after year, perhaps for 20 years, that the thing was stumbling along, and it took 25 years before it was successful. When a similar proposition is up, you men who have a vote in Congress will vote against it, on account of the public opinion which has been created, although it might otherwise be a very good proposition. Public opinion will be created against power development if the same kind of a mistake is made here. My point is that it would be better for this not to be done completely rather than to make a mistake that would interfere with the general power development or which will prevent our power developments from receiving a proper reception.

Senator KENDRICK. Is it not reasonable to suppose that the engineers have already considered the practical features of this power plant before it was begun?

Mr. MCCLELLAN. Yes; but I will say to you, without definite knowledge of it, Senator, that I do not believe from all I can learn in general conversation among engineers and business men, if the war had not come along Muscle Shoals would ever have been started as a commercial proposition.

Senator KENDRICK. I will say this to you as a business man, that I had no idea in the world that there was such a possibility of development of water power in the eastern part of the United States, outside of Niagara Falls and the St. Lawrence River, as there

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is right there. I live in the Rocky Mountains, and the flow of water at Muscle Shoals, as tested for 50 years, shows that the supply is dependable.

Mr. McCLELLAN. Yes.

Senator KENDRICK. You spoke a moment ago about the question of transportation. One of the features of this proposition that appeals to me is that there is water transportation right into the heart of the Nation and then out to the seaboard from this plant.

Mr. McCLELLAN. I am not denying any of those things. I am only pleading that all of this testimony that you have had here be brought together under a technical and business review, with the idea of solving that problem, not stopping it, not letting it alone, but getting a proper answer in the shortest possible time.

Senator NORBECK. Would you say that there would be sufficient revenue to justify a further investment so that it would be put on a paying basis within a reasonable time.

Mr. McCLELLAN. That should be considered as a matter of broad public policy, the same as you would build a great highway across the country.

Senator KENDRICK. We have the proposition, as I understand it, of the return to the Government of interest on the income from the dam from now on. I have never been able to understand why it should not include the amount already invested in the dam. That interest is at 4 or 4½ per cent, as I understand the proposition.

The CHAIRMAN. Four per cent.

Senator KENDRICK. Within the course of a few years we may hope for a more satisfactory return on the money.

Mr. McCLELLAN. Exactly, and it may be that the scale, the ladder or the spread of these charges are on a very different basis than what is proposed.

The CHAIRMAN. That reminds me, Mr. McClellan. Take this as an illustration, now: Of course, the Government ought to have some definite policy. I think it is conceded by engineers and scientific men that the right policy to get all the power there is out of a proposition is, when you take up a river like, for instance, the Tennessee, which we have embarked on, you ought to take it up as a whole.

Mr. McCLELLAN. Yes.

The CHAIRMAN. You ought to take up every tributary that flows into it.

Mr. McCLELLAN. Yes.

The CHAIRMAN. Especially in the southern country, and particularly in Tennessee, where the difference between the minimum flow and the maximum flow is so enormous; that that is the way to get the most economical results in the end, and that is what we are all striving for, that we should take up the whole Tennessee River.

Mr. McCLELLAN. Absolutely.

The CHAIRMAN. And build as many dams as may be necessary.

Mr. McCLELLAN. Wherever it is necessary to prevent the inequalities.

The CHAIRMAN. Now, when you take into consideration that broad fact, nobody can do that except the Government.

Mr. McCLELLAN. Nobody can do that except the Government.

The CHAIRMAN. Yes.

Mr. McCLELLAN. That is the reason I said in my opening remarks fundamentally I believed in the Government doing that sort of thing.

The CHAIRMAN. It may be, when we investigate, we will not find locations, perhaps, where it will pay to construct reservoir dams.

Mr. McCLELLAN. Exactly.

The CHAIRMAN. And if we can not find them we will have to give it up, of course. Now, when you come to a power proposition and if you amortize it over a few years, it would be prohibitive to put in this thing.

Mr. McCLELLAN. That is the thing.

The CHAIRMAN. But if the Government would go into it and amortize it over a period of a hundred years, perhaps 200 years, it fades away into nothing.

Mr. McCLELLAN. It fades into nothing. The Government, of course, can make these great improvements and raise the money through taxation by act of Congress. By increasing the income tax tremendously the Government gets an indirect return. Perhaps that is the only justification, in the last analysis, for putting such a burden on the general public, because everybody, either directly or indirectly, is benefited.

The CHAIRMAN. Of course, in this other scheme, if a private individual were himself to construct a dam to develop power, under the law he would be required, then, to contribute his share——

Mr. McCLELLAN. Yes.

The CHAIRMAN. To construct the reservoir sites.

Mr. McCLELLAN. Oh, yes.

The CHAIRMAN. Now, we have down there on the Tennessee River one of the most remarkable water-power propositions in the United States.

Mr. McCLELLAN. Yes; you have.

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The CHAIRMAN. Without any doubt?

Mr. MCCLELLAN. Without any doubt.

Senator KENDRICK. Well, if we were to begin the comprehensive plan of development that you gentlemen have outlined, would it not be the most practicable, the common-sense way to first build these dams that we have and then build your reservoirs for supplemental power as you find sale for the power that you had to begin with?

Mr. MCCLELLAN. Oh, unquestionably, sir.

The CHAIRMAN. You ought to first go ahead with the dam, of course. I am in favor of that. Then, you ought to have a comprehensive survey of the whole thing, and you ought not to wait until this country is all settled up and developed before you commence to build these reservoirs. If you do, the price is going to be prohibitive.

Mr. MCCLELLAN. As I say, I am very much in favor of this. I am personally interested in seeing the water-power development of this country go ahead. I want to see it go ahead in my business, but I am only pleading from the standpoint of the union of the Government and any private interest, I do not care who it is or what it is. The eyes of the people of this country are focused on this first great proposition, and we want to have this union of Government and private ownership in such a way that it will move along smoothly and help the situation. I hope it will go ahead quickly. The men I have in mind ought not to take any longer than six months on this proposition, because they have not the time to give to it, to sit around and have a whole lot of meeting to discuss this thing; but, in the last analysis, you may, for example, put your power dams there, if that is the wise decision, and you can supplement them with steam plants, probably, as time goes on. These other things might not happen for 20 years, and by that time these steam plants can be scrapped. That proposition is being worked out by private interests here and there.

Senator HEFLIN. When did you first become interested in this project at Muscle Shoals, Mr. McClellan?

Mr. MCCLELLAN. When did I first become interested?

Senator HEFLIN. Yes, sir.

Mr. MCCLELLAN. I had no interest in it except as an ordinary citizen during the war. At that time I had just the common interest of an ordinary citizen, and except for reading of it in the newspapers I knew nothing about it at all. About two years ago the American Engineering Council was formed, and projects were coming in to us with suggestions that we do something about Muscle Shoals—that is to say, to look into it and all that sort of thing. We began to think of the matter than in a rather desultory way, but not definitely. Then, when I became president of the American Institute of Electrical Engineers in August, we had various objections from different places to the effect that the American Institute ought to look at what was going on there in the interest of the general electrical, civil, and mechanical engineering, and it has been sort of growing, nontechnical, but rather a business and economical interest from that time on.

Senator HEFLIN. Various interests have suggested to you that Muscle Shoals was a good project and they wanted to have you look into it and express some opinions about it?

Mr. MCCLELLAN. No; I would not say that. I simply remember that various members of the council would get up and raise a question.

Senator HEFLIN. Did not they represent the same interests that would be liable to invest money down there and take over this project if they could get hold of it?

Mr. MCCLELLAN. No, sir. I will tell you frankly what it was. The Federated American Engineering Societies was formed by the big national societies getting together jointly with the idea of doing two things, and you will find this in their constitution, first, to assist the Government; and, second, to work for professional engineering. Now, all of the members of that board, with that idea in mind, were looking over the country and hunting projects, and you will remember they made a report on the reduction of waste in industrial plants. In order to carry out their constitution they were looking at various things all over the country that they might help in or do something in regard to, and I am very confident that it was just the individual desire of the members of the board in looking around, and they said, "Here is Muscle Shoals. apparently there is a great difference of opinion about it; one big manufacturer is trying to get it and certain other people are fussing about it. Why should we not take that up as a place where we can help the Government?" There has been no proposition that has come from anywhere, and I was chairman of the finance committee, and I was also an active member of the board, and I would know.

Senator HEFLIN. You never made your suggestion about appointing a committee to look into it until Mr. Ford and others had filed their offers with the Secretary of War?

Mr. MCCLELLAN. No, sir; and I know the advice that you have had has been from able men, absolutely, and I also know, in many cases, the very men who have been retained—and I do not raise a shadow of doubt as to their honesty, but I know they

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look at it from a single angle—have been before you. Now, we know all of this, and that is the reason I make this proposition this morning.

Senator HEFLIN. Well, if they were retained by Mr. Ford or anybody else to make a record of that project down there they were not doing anything more than the people who brought the matter to your attention.

Mr. MCCLELLAN. Exactly.

Senator HEFLIN. They were looking at it for themselves, and trying to get somebody to take this project up and develop it.

Mr. MCCLELLAN. Precisely. That is the point.

Senator HEFLIN. Now, after the Government ceased working on this dam you just permitted it to lie there and said nothing about it until somebody tried to get hold of it.

Mr. MCCLELLAN. Some of our members thought that this was a place we ought to look into. I do not know whether it was really to help or make a good name for their federation, or what it was.

Senator HEFLIN. They saw that Mr. Ford was trying to get it and then they said, "We will pitch in."

Mr. MCCLELLAN. I do not think I would take that point of view. One of the most active men we have there——

Senator KENDRICK. May I interrupt a moment right there, Mr. McClellan? I think what you intend to have us understand is that no member of your organization was financially interested in this.

Mr. MCCLELLAN. Oh, not a particle, or retained or connected in any way.

Senator KENDRICK. There was that difference?

Mr. MCCLELLAN. There was that difference. They were not actually retained.

Senator HEFLIN. But if a committee should be appointed and that committee should make a recommendation that a certain disposition be made of it, it may later on turn out that they will become interested, or you might have some interest in it.

Mr. MCCLELLAN. Oh, certainly; you can not tell anything about that.

Senator HEFLIN. No.

Mr. MCCLELLAN. That is true.

Senator HEFLIN. Now, Mr. McClellan, if a committee were appointed, would not these very interests who are now fighting Mr. Ford's offer, in one way or another, directly or indirectly, besiege the President to appoint a committee that would see to it that Ford did not get this project?

Mr. MCCLELLAN. Oh, my dear Senator——

Senator HEFLIN. And would not they impose upon the President by getting him to appoint men who would be interested in this project, and their service would amount simply to a postponement of the thing until these people got tired of fooling with it and would withdraw their bids, and then they would succeed in doing what a great many of them want to do, to keep anything from being done at Muscle Shoals in the hope that they can buy it later on for nothing, practically?

Mr. MCCLELLAN. I would only agree to a part of your proposition, sir. I believe every interest in this country wants the development of Muscle Shoals, and if there is any that does not it should. I believe that any interest in this country that wants Muscle Shoals developed, that wants it developed by a special plan, would besiege the President and you men in Congress here. They would besiege everybody. Now, if you ask me whether they would not impose upon the President, I can not be so uncomplimentary to the President of the United States——

Senator HEFLIN. Well, Presidents are frequently imposed upon.

Mr. MCCLELLAN. Well, that may be, but I think he would have equally good advice from another direction, and while mistakes might be made I am confident that what I am proposing here is not a commission to settle this thing. I am not proposing that at all. I am leaving the settlement of this thing to engineers who are doing this work. You can put it entirely in the hands of this committee, acting together with the committee of the Senate and the committee of the House, and they would come to a decision. This committee that I suggest would publish no report. They would hand in a report to the chairman of this committee, and would act, so to speak, as advisers in the matter.

Senator HEFLIN. Is it not the man, though, who persistently works at a thing who finally succeeds in putting it over; is not that true?

Mr. MCCLELLAN. I do not think there is any question about that.

Senator HEFLIN. Now, as to these people who want Muscle Shoals, who do not want Mr. Ford to have it, would they not be the most likely people in all the country in seeing to it that the President appointed a committee that would be favorable to their ideas in the matter, and might they not get behind some man here and yonder

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that the President would not know, a man that he did not think had any connection with these big interests, and when the commission was appointed the President might find that he had a commission that was not so disinterested, perhaps?

Mr. McCLELLAN. If I were to agree to that proposition——

Senator HEFLIN. But a commission that would do exactly what these people want done?

Mr. McCLELLAN. If I would agree to that proposition I would be agreeing to the fact that there can be no government except by interests, and I do not believe it. That would be agreeing to the statement that this committee right here could not decide it somehow or other. I do not believe it. Do you mean to tell me that this committee or the President of the United States or anyone else can not, if they want to, get a group of men who will give them disinterested advice, in spite of the fact that the interests might be working against it?

Senator HARRELD. We would be in bad shape if that were the situation.

Mr. McCLELLAN. There would be no government, absolutely none, if I said yes to that proposition; so I have to say a very decided no, if I have any faith in the intelligence of men.

Senator HEFLIN. We know that commissions have frequently been appointed who have not served the interests of the country as a whole, and when you appoint a commission to look into a thing like this, you are just simply postponing the day when the development will take place.

Mr. McCLELLAN. Well, I have only to say to that that I do not plead for postponement. I do not call six months——

Senator HEFLIN. Take this, for instance: You would be willing to serve on the committee?

Mr. McCLELLAN. Well, I am the president, and I did not say that, but——

Senator HEFLIN. Yet you have committed yourself here to the proposition that you would be willing to leave that dam just like it is, which stops navigation on that river when, prior to the construction of it there was navigation there for 10 months in the year; you would injure navigation and commerce to that extent and you would permit all of these cofferdams to be washed out and to deteriorate, and you would let everything else there deteriorate, rather than to spend $7,500,000 that is necessary.

Mr. McCLELLAN. Does any other member of the committee think that I said that? If he does, I wish to correct that at once, if anybody got the impression that I would not spend every dollar necessary to hold that thing right where it is and prevent one dollar's worth of deterioration. I have said that distinctly.

Senator HEFLIN. Yes, I believe you did after it was corkscrewed out of you, but I got the impression at the outset that you were just as willing to let it stand there.

Mr. McCLELLAN. If I may have my remarks read, sir, you will see that I said before Senator Norris raised the question that the first thing I would do would be to protect the improvements there.

Senator HEFLIN. Then, the chairman suggested to you that it would take more than $7,500,000, a good deal more, and I understood you to say that you would spend some money and just hold what we have got there, but not complete if for the present.

Mr. McCLELLAN. Pending the six months' decision as to the best way to do it.

Senator HEFLIN. Yes.

Mr. McCLELLAN. That is all.

Senator HEFLIN. Do you think it is the business of such a commission to tell us what is the best thing to do down there when months and months elapsed after the Government withdrew its forces and quit work on the dam, and when you and other engineers said nothing about it whatever; you were silent as the tomb, but when Mr. Ford made us an offer and when some others make offers, and it looks like Congress is about to dispose of it and complete navigation on that river, and develop that power. you will come in and suggest the appointment of a commission. Now, why were you silent for all of those months about the development of that project down there?

Mr. McCLELLAN. Why were we silent?

Senator HEFLIN. Yes.

Mr. McCLELLAN. It was probably simply because we were not up to the point of doing those things promptly. Personally I have no hesitancy in saying that I had a letter written just before this proposition came to Congress at all, while it was still in the hands of Secretary Weeks, and I destroyed the letter when I found it was turned over to Congress, feeling that it was too late to write to him. I think this proposition ought to have been adopted long ago and I think we, as engineers and as citizens of this country, if we had been alive to our responsibility in the matter, should have made this proposition long ago. I think we have been remiss in delaying things so long.

Senator KENDRICK. You place it on the ground that there had been no discussion of it.

Mr. McCLELLAN. It was just a case of being nobody's business.

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Senator HARRELD. A case of what is everybody's business is nobody's business.

Mr. MCCLELLAN. If my mind had gone in that direction I might very well have telegraphed, "I can not come down to-day, I am very busy," and have stayed out of it still longer. Frankly, I decided personally and privately to come down here and have this talk.

Senator HEFLIN. And we are very glad to have the benefit of your suggestions in the matter.

Senator KENDRICK. I do not know whether you have been in touch with it or not, but it is generally conceded that the cost of improving the navigation will not materially increase the cost of the dam.

Mr. MCCLELLAN. That is right, sir.

Senator KENDRICK. I think that is something of an incident, as I understand it.

Mr. MCCLELLAN. It is.

Senator KENDRICK. It enters in as a part of it, without increasing the cost particularly.

Mr. MCCLELLAN. As I explained a few minutes ago, $7,500,000, while a very serious sum of money, would not be considered a greater sum by the government than if a private corporation spent $75,000 or $750,000.

Senator NORBECK. If I understand correctly, this proposition has been open to the general public for many years under the water power act, and if these interests are really suspicious, all of that time they could have gone into it and developed it if they had seen any profit in it; is not that right?

Mr. MCCLELLAN. No; not under the water power act. That was only passed six years ago, I believe, although I am not certain as to just when it was passed.

Senator NORBECK. Well, it came under the water power act at one time, and it was open to the general public. Anybody could have applied for it.

Mr. MCCLELLAN. Anybody could have applied for it if they thought they could make money out of it.

Senator NORBECK. And it did not look promising from an investment standpoint.

Mr. MCCLELLAN. That is it.

Senator NORBECK. The weakness of that development lies in the fact that the river is so very wide that a dam is rather expensive for the horsepower to be developed.

Mr. MCCLELLAN. I think that is undoubtedly true, but, in addition to that there is the fact that you have a period of years to wait before the market is built up. I went all through the Niagara Falls development, and if you will recall, they originally built a transmission line 150 miles, to Syracuse, to help them get a market for it. So far as Niagara Falls power is concerned, that line is not necessary now, because every bit of power can be used right there at Niagara Falls.

Senator NORBECK. That is what I am getting at. If we had the dam completed, and if only one-half of it or one-third of it was available, would not the very fact that there was a supply of power there available tend to produce a market?

Mr. MCCLELLAN. That is the only way a market will ever come.

Senator NORBECK. Therefore, we should be a little ahead of the market instead of a little behind it?

Mr. MCCLELLAN. That is the idea; but I am anxious that when the Government joins private interests in doing this thing it will be an encouragement to take up other things and go ahead in the right way and develop the country.

Senator HEFLIN. But that plant down there has been abandoned, and none of these big concerns were interested in the fact that it was abandoned. They did not want it developed unless they could get hold of it, and it was natural for them to wait until a few months or years had gone by, when they could say, "It has been neglected now for so long, we will take it as so much junk." It was neglected and abandoned and Mr. Ford came along and he took Mr. Edison with him, and they marveled at the possibilities that they saw there, and Mr. Ford came back and went to the War Department and made an offer. He said, "It has been abandoned; I will take this thing over and I will manufacture fertilizers down there."

Senator NORBECK. "If I can make 8 per cent interest."

Senator HEFLIN. He said, "I will practically cut the price in half," and that means a great deal to the farmers of this country.

Mr. MCCLELLAN. What bond does he give? Have you a guarantee that he will do it for you?

Senator HEFLIN. Well, we are going to get him into a contract that he will make fertilizer. He would not, of course, guarantee that he would cut the price in half.

Mr. MCCLELLAN. Does he want any Government help?

Senator HEFLIN. But he claims that he has a secret process, and we know that the fertilizer trusts are fighting him and do not want him to have this. They have been carrying on propaganda work here, writing to Senators and Members of the House,

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against turning this project over to Mr. Ford. The power companies are fighting him, too. But he went down there and saw this thing, and then he made this offer to the Government, and then one or two other offers came in. Various witnesses have been here testifying that this ought to be done and that that ought to be done, and it seems to me that there is a disposition in it all to keep Ford from getting it. There is a concerted effort to keep him from getting it.

Mr. McCLELLAN. Of course, I do not know anything about——

Senator HEFLIN. His offer has been indorsed by the farmers of the West and the farmers of the South, and if it is accepted it will serve a great and good purpose. It will open up navigation, it will develop power, and it will manufacture fertilizer and give the poeple there employment, as I understand he is going to build an industrial city down there. He has the money to do it with; he is a wonderful man and it looks to me like some of these other concerns simply do not want him to get it.

Mr. McCLELLAN. Suppose Mr. Ford goes broke in three years, and the Government is saddled with something of that kind. What are you going to do then? How do you know that Mr. Ford or anybody else is going to be in a position to carry out all of these promises?

Now, I hope Mr. Ford will get it, if his proposition is a good one, and your investigation shows it. I have no objection to Mr. Ford, but what we need is information.

Senator HEFLIN. Yes; we got a lot of information on it, and this information was not sought until Mr. Ford made his offer. That is the point I am making.

Mr. McCLELLAN. So it is possible, sir, that that might be an argument against it, for the very reason that the proposition may not be valuable in that sense, and the information was not necessary.

Senator HEFLIN. It appears to me that those interests who do work in concert just simply intended that that thing should lie still until in their own time they would take it up and get it for a song from the Government; but Ford heard of it and went down there and saw it with Mr. Edison, and said it was a great thing, and it ought to be developed. Now, after Mr. Ford came back and made the offer, here come various interests telling what a great thing it is and it ought not to be turned over. I think it is their hope that if the Government undertakes to develop it and does not let somebody else have it, it is not going to be developed. I believe that those interests think that if the Government holds onto it they can prevent development down there.

Mr. McCLELLAN. Those interests are even more powerful, do you think, than the United States Government?

Senator HEFLIN. No.

Mr. McCLELLAN. I do not understand if the President of the United States and the Cabinet and Congress all are here to represent us as the United States Government—I hesitate, sir, very seriously, to think that I have got to go back home and think that there are interests here that are going to defeat this United States Government; that we can not solve this problem because of those interests.

Senator HEFLIN. Here is a combination that says it ought to be postponed until a commission can look into it.

Mr. McCLELLAN. What combination? I would like to have that settled. Do you mean my proposition?

Senator HEFLIN. I say here is a combination of interests among the people who will say that it ought not to be developed until a commission can look into it and say what ought to be done with it, and a few members of Congress maybe will be for that. Here is another proposition that says the Government ought to develop it, and all of them conscientious, and a few will gather behind that proposition. Then there are others who will say that this interest ought to have it, or that, and we will divide on that. So the interests who do not want development success, whether they do it directly or indirectly.

Senator NORBECK. If I had the faith and confidence in human nature that you have I would not vote to spend one dollar on the Tennessee River or any other river.

Senator HEFLIN. I have great faith in the Government and great faith in the people of the Government, and a great deal of love for the people of the United States, and I am doing my best to serve their interests and not those of the special interests of the country.

Mr. McCLELLAN. May I simply say I can not take your point of view, sir? But this is my picture: I see a great project there in which the Government and private interests have got to join. I see a committee here which has one of the most serious responsibilities any committee ever had in the economic problems of our country; and I see back of that committee the President of the United States, who will have to finally join in it, I suppose, and I simply come here, not in any interest. I represent no interest. I am not connected with any interest. All the engineers of this country are offering to place their services at your disposal, not to impede this propo-

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sition, not for elaborate investigation, but to help you to solve the problem, that is all—help you to arrive at a conclusion, taking from three to six months to do that. If that is too long and you want a shorter report, the same group of men would individually do the best they could in a shorter period. If you want to have all this in two months or three months, they will help you to do what I do not believe you can do as well without them. That is all I am offering, and it is up to you to fight those interests, if they are there. It is not our business to fight the interests, except to retain our own personal integrity and give you information as we see it.

Senator HEFLIN. I am interested in having this project developed down there in a way that will serve the most people in the country, and I believe the offer of Henry Ford will do that. He is the only one who proposes here to make fertilizer.

Senator NORBECK. What does the Ford offer propose, Senator, in the way of fertilizer? The farmers of the country are interested in that more than in anything else.

Senator HARRELD. The trouble is that a great many of us want to adopt a resolution to accept Ford's offer, whatever it is. I can not swallow that kind of thing.

The CHAIRMAN. Let me suggest that as we go along we do not discuss these various offers. When we get through with all the witnesses and the others, we will lock the doors and fight it out amongst ourselves.

Senator NORBECK. And you will act as referee.

The CHAIRMAN. Are there any further questions anyone desires to ask Mr. McClellan? If not, Mr. McClellan, we are very much obliged to you for your information.

Senator KENDRICK. Mr. Chairman, I think it might be important to confirm the impression I have in regard to Mr. McClellan's attitude.

As I understand you, your attitude is that of a citizen of the United States. You are president of the American——

Mr. MCCLELLAN (interposing). The American Institute of Electrical Engineers.

Senator KENDRICK. A group of men who would naturally have information and general information on all such questions as this?

Mr. MCCLELLAN. Yes. There are 13,000 of them.

Senator KENDRICK. You are concerned in this more particularly because of the fact that it has to do with your line of work? That was the first thing that attracted your attention? Is not that it?

Mr. MCCLELLAN. Yes. We think we have an understanding of the problem.

Senator KENDRICK. And your interest here is in no sense a financial one?

Mr. MCCLELLAN. Oh, not the slightest. I do not expect to have the slightest thing to do with this thing. I know I won't be employed in connection with it. I know that.

Senator KENDRICK. Is it your idea that the gentlemen who would serve on a commission appointed would serve for pay or without pay except expenses?

Mr. MCCLELLAN. My idea was that they were to serve without pay.

Senator KENDRICK. That was my impression.

Mr. MCCLELLAN. Absolutely. I used the word "invited" and not "appointed"; invited to serve and to serve without pay. I suggested that the expenses of summarizing and analyzing the information would really be the expense of your committee, so to speak, and it would not have to pay us, even as a commission, for that, but if you would arrange, as a committee, to do that work. You have got to analyze it, I suppose. You have got to summarize it; you have got to get it in shape. We simply come in and do that, and study the stuff, and make a general report.

Senator KENDRICK. I am interested in clearing up these points because that was my idea of the witness's attitude, and, personally, I think that we could not, any of us, afford to do other than appreciate in the highest degree that disinterested spirit of citizenship that wants to see the Government proceed not without information but wisely and well.

Mr. MCCLELLAN. Let me say further, sir, that I mean, too, that of course the Senate committee would do all the appointing; that when you invited these men to serve you would have before you in the greatest detail their lives and every activity in it. We do not propose to offer five men to you that you either accept or don't accept, but we simply join with you in helping you get people. If you don't want this person or that person, you will have their lives before you, you will have the appointing, you will have the selecting with your eyes wide open with regard to the name and integrity and standing of great societies in this country that have Mr. Ford's engineers as members, with every big company, corporation engineers, members of it, every engineer of prominence in this country being a member of the American Institute of Electric Engineers—every electrical engineer. Therefore my board of directors and I myself can not do anything and will not do anything that is going to break the good name of that society that has been in existence for so many years, with all these divergent interests clashing in it, because we would hear from it in a moment.

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Senator KENDRICK. It is also true that the information submitted to this committee for consideration would not have any binding effect on the committee whatever?

Mr. MCCLELLAN. None whatever, and would be absolutely confidential.

Senator HEFLIN. Would you not have the same trouble that this committee is having? Suppose you appointed a committee of five or six. What would happen as soon as those men were appointed? Would not the various interests come in and lay their plans before them?

Mr. MCCLELLAN. We would have no hearings. We would pay no attention to anyone. We are not an investigating committee. You are the investigating committee.

Senator HEFLIN. Then you would not seek any information at all?

Mr. MCCLELLAN. We would go down to the project itself and look it over. I don't believe anything we could do would give us any more information than you have before you as to the Army engineers' costs, Mr. Ford's costs, and other things like that; and if we wanted anything of that kind, I think probably—I don't know; I can not speak for this commission, but they would be under your direction absolutely, and I imagine that they would ask you to get any such information they wanted.

Senator HEFLIN. This committee went down there and, so far as I know, every member of it was wonderfully well pleased with what he saw, and every one of them came back stating that the thing ought to be completed at once; that there ought not be any delay about completing that dam, and that it was an outrage to let that great project stand idle and that water power go to waste and the navigation be obstructed as it was being obstructed. If we appoint a commission of six and postpone it for six more months, that commission might report that something ought to be done on it, and somebody else will suggest another step to be taken in order that development might be had. In the meantime these people who are bidding for this thing might say, "Oh, well, they are not going to do anything," and quit and go and invest their money somewhere else. Then, if they did, this project might remain as it is now, and some of the concerns who hope to get it some day for nothing will succeed. That is what I am afraid of.

Senator KENDRICK. Senator Heflin, assuming that the committee proceeded to do the things that they have agreed upon; for instance, we practically agree on the advisability of securing an appropriation through Congress, if possible, to proceed with the completion of the dam. The experts tell us it will take three years to complete the dam and that they will find it necessary to employ as much as $7,500,000 during the year 1922. We could proceed to get that under way as fast as possible. Such a commission as Mr. McClellan has suggested could probably report their recommendations to us before we could decide ourselves, and it would bring that much more actual practical experience to bear on the general situation.

Senator HEFLIN. But what member of this committee—I am ready to act as soon as these hearings are over. I think I know what I want to do in regard to that thing. I believe I know what two-thirds of the people of the United States want done. I don't think there is any doubt on earth about seven out of every ten people in the country being in favor of Ford having this proposition.

Senator NORBECK. Without knowing what he has guaranteed in the proposition that he makes.

Senator HEFLIN. That he is going to manufacture fertilizer cheaper than it is now being manufactured.

Senator KEYES. How many people in the United States do you think know what the Ford offer is?

Senator HEFLIN. Oh, all of them, Senator.

Senator NORBECK. I am frank to say that I did not know until the last 10 days.

Senator HEFLIN. Very wide publicity has been given to it. Very wide publicity.

The CHAIRMAN. Let us eliminate any decision as to Ford and these other fellows and go on with the testimony.

Senator HEFLIN. Just one other thing, Mr. Chairman, in response to Senator Kendrick. They want to put off six months with this commission. That just postpones action that much longer.

Mr. MCCLELLAN. Make it three months. I said this commission could make a shorter report in three months.

Senator HEFLIN. And I don't think this commission would help this committee one particle.

The CHAIRMAN. Again let me suggest, gentlemen, that we are not going to pass on the question whether we are going to get a commission or not. We will do that when we have gotten together in executive session to fight this thing out. Let us not debate that now. Let us go on with the evidence.

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Senator HEFLIN. All this record will be read, Mr. Chairman, long after this controversy is over, and we want to get in all the facts that occur to us and the interests involved.

The CHAIRMAN. Yes; but we are taking evidence now; we are not going to debate that now.

Mr. MCCLELLAN. It is clear, is it, Mr. Chairman, that I agree on the wisdom of spending that $7,500,000 now?

The CHAIRMAN. I think so.

Mr. MCCLELLAN. The only thing I said was that, of course, it was important that we should not lose a dollar of what has been done there, and should go ahead.

The CHAIRMAN. Yes. I think we have a clear understanding of it.

As to when this question of what we are ultimately going to do with it will be decided, I think everybody knows, from the way things are decided in Congress, it is going to be a good while before we do it. I confess I would like to do it to-morrow, but I won't have my way about it. Neither will the rest of us. It is a big question, and we will not get it through this Congress. We know we won't get it through this Congress.

Senator HEFLIN. I don't agree with that, Mr. Chairman.

The CHAIRMAN. I hope you are right, Senator Heflin, but you know how these things go in Congress.

Senator HEFLIN. Yes; I do.

The CHAIRMAN. And with the tariff dragging along and the other things, the fellows that want to get in their campaign and get through and get home, I think it is hopeless to think of getting it through this Congress.

Mr. MCCLELLAN. It is of the greatest importance that you get that thing in shape so you won't lose anything.

Senator HEFLIN. We have to get that $7,500,000 through this Congress.

Mr. MCCLELLAN. That looks to me very reasonable.

The CHAIRMAN. If there is not anything further, Mr. McClellan, we will excuse you. We are much obliged, sir.

Mr. MCCLELLAN. You are entirely welcome.

STATEMENT OF MR. GRAY SILVER, WASHINGTON REPRESENTATIVE OF AMERICAN FARM BUREAU FEDERATION.

The CHAIRMAN. State for the record whom you represent.

Mr. SILVER. Yes, sir; I am Washington representative of the American Farm Bureau Federation.

I will begin this testimony, gentlemen, by reading you the resolutions adopted by our organization.

First is a resolution of the American Farm Bureau Federation presented and adopted at its annual meeting held at the Hotel LaSalle, Chicago, on March 4, 1920:

"We support the measure pending in Congress looking toward the operation of the nitrate plant No. 2 at Muscle Shoals for the production of nitrogen fertilizer compounds."

Resolution passed by the American Farm Bureau Federation at the annual conference at Atlanta, Ga., in regard to Muscle Shoals. This was November, 1921:

"We recognize in the Muscle Shoals nitrate water-power project in Alabama such an essential measure to secure the preservation of our soil resources, as well as to develop the industrial and transportation facilities of our Nation, that we urge the Congress of the United States to authorize the Secretary of War to enter into such contract or contracts with Henry Ford for the completion and continuous operation of the project as will protect the public welfare. If such authority is not promptly given, we reserve the right to institute such action as will guarantee the completion and operation of this enterprise under Federal supervision."

Resolution adopted at the meeting of the Southern Group of the American Farm Bureau Federation, at Florence, Ala., January 20–21, 1922:

"Several hundred farmers representing the many thousands in organized agriculture, from 15 Southern States, as well as delegates from the West and Far West, after careful investigation of the dams and power plants at Muscle Shoals, Ala., believe it to be an economic crime to continue to allow this development to lie idle and uncompleted.

"As a means to proper development we unreservedly indorse Henry Ford's offer to lease and operate the power and nitrate plants.

"We reiterate the stand taken at the last meeting of the Farm Bureau Federation in indorsement of the Ford offer.

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"We recommend that Congress authorize the issuance of bonds necessary to complete the dams at Muscle Shoals. This will avoid the necessity of taking funds direct from the Treasury. Henry Ford's offer would pay interest on such bonds, and the first earnings from the sale of electrical energy would amortize the bonds."

Resolution adopted in regard to Muscle Shoals at the agricultural conference called by Secretary of Agriculture Wallace at the request of President Harding, January 23–27, 1922:

"*Resolved*, To accomplish results without any further delay whatsoever, we urge the Secretary of War to recommend and Congress to accept Henry Ford's proposal to take over the hydroelectric power and air nitrate plants at Muscle Shoals under a guaranty to operate the same for 100 years, at its present capacity of approximately 100,000 tons of ammonium nitrate per annum, opening the Tennessee River to navigation, cheapening the production of fertilizer, metals, and other commodities, and assuring the United States nitrogen independence in peace or war."

This matter was not acted upon by the Farm Bureau Federation or its units in a guesswork way. Prior to the adoption of some of those resolutions, perhaps all of them, they appointed a committee which was sent to Muscle Shoals and did go on the ground, examine the property, and get such technical advice as they saw fit, and they made this report to our organization, and I would ask that that be inserted. I think I have enough copies here for each member of the committee.

The CHAIRMAN. Is that the same report that you furnished me a copy of some time ago?

Mr. SILVER. Possibly so.

The CHAIRMAN. When was that issued?

Mr. SILVER. I could get the date from the office. The report itself is dated May 31, 1921.

The CHAIRMAN. When was this committee appointed, Mr. Silver?

Mr. SILVER. At some previous time. I don't know how long previous.

The CHAIRMAN. How many members were on that committee?

Mr. SILVER. Three. Their signatures are in the report.

The CHAIRMAN. Yes; W. G. Jamison, president Colorado Farm Bureau Federation: John G. Brown, president Indiana Federation of Farmers Associations; and Chester H. Gray, president Missouri Farm Bureau Federation. This report is dated Washington, D. C., May 31, 1921.

Mr. SILVER. That is when the report was made, and those are the men who made it.

The CHAIRMAN. I suppose the report itself shows when they were appointed and where?

Mr. SILVER. I think so.

Mr. BOWER. I don't think it does, Mr. Silver. We could get that.

Mr. SILVER. If you care for that information I would be very glad to supply you with it.

Senator CAPPER. My recollection is that they were appointed shortly after the defeat of the Muscle Shoals legislation here in Congress.

Senator NORBECK. Would it not be more appropriate to put the conclusions of this report in your testimony and refer to it, than to incorporate all of this in our hearings?

Mr. SILVER. My reason for asking that that be included—not that I am going to urge it—was that you would have exactly before you the reaction in the minds of the committee that went on the ground and that visited and examined this place, and upon what they base their conclusions. I think that might be a feature that you would care for. You might take the same facts and arrive at that conclusion or some other one, but they give the facts upon which they base their conclusion and give their conclusion.

Senator HARRELD. Has that been published in the House hearings?

Mr. SILVER. Yes. They asked for it.

The CHAIRMAN. Just hand it to the reporter.

(The report referred to is as follows:)

REPORT OF THE MUSCLE SHOALS COMMITTEE OF THE AMERICAN FARM BUREAU FEDERATION.

To the executive committee, the American Farm Bureau Federation.

GENTLEMEN: Your committee which was appointed to investigate the Muscle Shoals project has performed that duty in the double capacity of personally inspecting plants and by collecting the available information from all sources for your consideration. We beg leave to report as follows:

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I. Introduction.

Since the signing of the armistice on November 11, 1918, many of the operations in which the Federal Government found itself engaged prior to that date have been discontinued on account of a peace-time basis not requiring certain war expenditures and activities to be continued. It is with a great degree of gratification that all citizens see our Government gradually discarding all expenditures and all projects that were purely incidents of the great war. There are a few undertakings, however, the necessity for which had been seen before our entrance into the war, that deserve the fullest consideration both by urban and rural citizens to ascertain whether or not it is best to continue them indefinitely for the good of the general public.

There is no problem of conservation more vital than that of preserving the fertility of the soil of our country. Those who dwell in cities are essentially as much interested in this task as are those who actually till the fields. The food of our nation mus t come largely from a well-preserved soil, and that soil necessarily must carry, either naturally or in the form of fertilizers, the proper nitrogen content. It has been said repeatedly that agriculture in its broadest sense has been neglected by the Federal Government in various ways. It is hoped that a genuine national policy of soil conservation and food production will be furthered at this time by taking such action relative to securing an adequate and economical supply of nitrogen as is recommended elsewhere in this report.

The outstanding war-time project which can be continued as a peace-time undertaking while at the same time retaining all its war-time functions for public safety is the Muscle Shoals project in Alabama. On account of the magnitude of this project not only in size but in importance to the whole nation, your committee has thought it well to report in a comprehensive way and at some length. For clarity of presentation the subject matter has been divided into eleven parts with frequent comment by the committee and with two very definite recommendations at the conclusion of the report.

II. What Was Seen at Muscle Shoals.

(*a*) The Tennessee River at Muscle Shoals, from which power is to be taken to operate the nitrate plants and for other purposes, is as large, taken at the mean or average flow, as is the Ohio River at Cincinnati, Ohio, the Mississippi River at Dubuque, Iowa, or the Missouri River at Omaha, Nebr.

(*b*) The banks of the Tennessee River at Muscle Shoals are of such height that a hundred-foot head water may be held without building any retaining walls or dikes whatever except the dam proper.

(*c*) The pool formed by the dam will extend for a distance of 15 miles upstream, and the total amount of land flooded or damaged by the water is 9,000 acres. This area has been bought and paid for by the Government with a very few exceptions, where condemnation proceedings are now nearing completion. This land was secured at an average price of less than $45 per acre.

(*d*) The Wilson Dam is about one-third completed and more than one-third paid for, as will be seen when the immense expenses attached to the preparatory work are considered, which expenses do not again have to be met in finishing the project.

(*e*) Two sections of the Wilson Dam—one at the north bank and one in the center of the river on an island—are partially completed. There yet remains for construction on these sections the discharge gates at the top and the roadway above the gates.

(*f*) The foundation is laid for a large portion of the rest of the dam and the protecting cofferdams have been removed.

(*g*) The excavations for the power plant and south section of the dam have been made under protection of an immense cofferdam which will permit work to be carried on in that section if the work is not too long delayed.

(*h*) A construction bridge carrying several railroad tracks, and supporting seven derricks, each capable of lifting 10 tons, has been built.

(*i*) Twenty-five miles of railroad track have been laid to haul supplies, rock, sand, cement, concrete, etc.

(*j*) Several locomotives, some of which weigh 65 tons each, have been used constantly in hauling material to the concrete mixers and thence to the dam.

(*k*) Three mixing plants with capacity to keep all the other equipment moving at full speed have been installed, one on the island near the center of the stream, one on the north shore, and one on the south shore.

(*l*) A large construction camp has been erected with individual homes for married men, bunk houses and mess buildings for single men, and administration offices and residences for the official corps.

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(*m*) The Wilson Dam is 4,100 feet long; its base, which is sunk 12 to 15 feet into the solid rock of the river bed, is 160 feet wide; its height from the original river bed to the bottom of the overflow gates is 80 feet and to the roadway on the top 120 feet. This structure when completed will be the largest single piece of monolithic concrete construction in the world.

(*n*) Two locks for navigation purposes are being constructed at the north end of the dam, each one having a lift of 45 feet and with other dimensions adequate to accommodate the largest river craft.

(*o*) Nitrate plant No. 2 at Muscle Shoals stands to-day fully equipped and capable of producing 110,000 tons per annum of ammonium nitrate.

(*p*) The site on which this plant is built comprises approximately 2,000 acres.

(*q*) At the height of operations on this plant 20,000 workmen were employed. It was built in one year, and the first ammonium nitrate was produced one day less than a year from the time of starting construction work. At that time 90 per cent of the mammoth plant was finished, and to-day it is 100 per cent complete for the production of fixed nitrogen.

(*r*) The steam power plant was built so that nitrate plant No. 2 could begin production without waiting for the completion of the Wilson Dam, which was expected to take approximately three years. This steam plant produces nearly as much electrical energy as any other steam plant ever built, and contains one steam turbine unit with electrical generators which generate 60,000 kilowatts, or 80,000 horsepower, being one of the largest turbines ever constructed and operated. In addition there is place for a smaller unit which would be capable of producing 30,000 kilowatts, or 40,000 horsepower, making a total horsepower for the entire steam-power electric plant when completed of 120,000, which is ample to operate the electric furnaces in another part of the plant.

(*s*) The boiler room of this immense plant comprises a battery of 15 units, each rated at 15,000 horsepower. These boilers when running full capacity consume approximately 1,500 tons of coal each day, which fuel is dumped from the cars on overhead tracks into vast bins, and thence fed into the furnaces by automatic stokers without being touched by human hands since leaving the mine. The three stacks to provide draft for these furnaces vary in height from 275 feet to 300 feet and in diameter at the base from 23 feet to 26 feet.

(*t*) The kiln room, where the lime rock is burned to lime, contains seven cylindrical kilns which turn slowly and which are heated by a blast from finely ground coal. These kilns are of steel, lined with fire brick, and are so mounted that the lime rock when placed in the higher end will gradually travel the entire length of the kiln, which is 125 feet, and emerge from the lower end as burned lime. Approximately 1,500 tons of lime rock can be burned in a day, which shrinks in the form of burned lime to about one-half that weight.

(*u*) The electric furnace building where the burned lime and coke are fused electrically into carbide, as the first step toward fixing nitrogen, is about 1,000 feet long and contains 12 electric furnaces, each of which requires 10,000 horse power for its operation. Only 10 of these furnaces are expected to operate at any one time, leaving two for repairs at all times. The giant electrodes through which the electrical current passes and which furnish the heat for fusing the burned lime and the coke, are subjected to such terrific heat that they have to be renewed every three days. This shows the necessity for extra furnaces. Each furnace produces 50 tons of carbide per day, or a total for the 10 furnaces of 500 tons. Practically all work of handling the materials used in nitrate plant No. 2 is done by machinery. However, these electrical furnaces must be fed by hand in order to fill the blow holes that appear in the molten mass, which unless filled by shovelfuls of coke and lime, cause rapid radiation of heat.

(*v*) The plant where nitrogen is taken from the air by the liquid-air process is many times larger than any similar plant ever constructed. In this plant nitrogen testing 99.9 per cent pure is secured in volumes aggregating 500,000 cubic feet every hour. The oxygen and a small part of the nitrogen are returned to the atmosphere.

(*w*) The oven building contains 1,536 ovens in which the nitrogen is fixed, or caught, in the carbide. Each oven is about 3 feet in diameter and 5 feet deep, holding approximately 1,600 pounds of carbide. This charge is heated, electrically, to white heat and the nitrogen from another building is forced through it and is caught. The product from these kilns is cyanamid or lime nitrogen, and contains 21 per cent of fixed nitrogen.

(*x*) The autoclave building contains 56 cylindrical steel autoclaves, which are steam-tight vertical boilers with agitators to stir the powdered cyanamid in order to drive off the ammonia gas. Each autoclave holds four tons of the powered cyanamid and it takes about an hour and one-half to get the fixed nitrogen out of the cyanamid and

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into the form of ammonia gas in order later to convert it into ammonium nitrate for military or agricultural purposes.

(*y*) Many smaller buildings, each of which is indispensable in the complete process through which lime, coke, and air must go in order to get nitrates for either explosives or fertilizers, are component parts of the gigantic whole of nitrate plant No. 2. In all there are about 30 buildings as units in this plant.

(*z*) Nitrate plant No. 1 is a much smaller plant than No. 2, and is designed to secure nitrogen from the air and fix it for military or agricultural uses by an entirely different process than the one used in No. 2. It has never operated on a commercial or practical scale but is completely equipped for operation.

COMMENT BY THE COMMITTEE.

The information given above contains some remarkable facts which your committee feels free to comment upon, not in the way of specific recommendations but rather that you may be informed what relation these facts bear to our welfare as citizens and as farmers.

(*a*) That the Wilson Dam contains the possibility of developing a hydroelectric plant far in exceess of any yet contemplated in America with the exception of Niagara Falls is evidenced by the fact that it will maintain a head of water almost 100 feet high and has the volume of flow referred to in II (*a*), whereas the great Keokuk Dam across the Mississippi River holds only a 40-foot head of water.

(*b*) There seems to have been no graft in the Government's acquisition of the land which will be inundated. The average price paid for this land seems to your committee to be entirely within reason; furthermore, there appears no likelihood of litigation subsequent to such inundation.

(*c*) Millions of dollars, undoubtedly, have been spent in the preparatory work which necessarily had to precede actual construction. Now that all this preparatory work has been done and paid for, it is the thought of your committee that legislation and appropriations should be provided for in Congress to avoid the loss of all this preliminary construction.

(*d*) The engineers in charge of construction work on the Wilson Dam state that although only about one-third of the permanent work has been completed more than one-third of the total expense has been met, on account of the cost of the preparatory work.

(*e*) Your committee is impressed with the necessity for a resumption of building operations on the dam, which were discontinued in April on account of a lack of appropriations.

(*f*) It is needless to state that the great steam plant which is capable of running all of nitrate plant No. 2 was built only to operate the plant until the Wilson Dam could be completed and furnish a cheaper power. The steam plant should now be considered as an auxiliary power plant to the hydraulic development, as nitrates can be made much cheaper with hydraulic than with steam power.

(*g*) Your committee desires you to remember that in the fixation of atmospheric nitrogen in the lime-nitrogen process some substance must be made that will soak up nitrogen somewhat as a sponge does water. Carbide, which is made by fusing lime and coke in an electric furnace, is the material used in nitrate plant No. 2. However, it is a chemical reaction that takes place and not a physical one.

III. Availability of Nitrate Plant No. 2 for Manufacturing Fertilizers.

It is a generally recognized fact that up to a certain point the manufacturing of nitrate for military or for agricultural uses follows a common course. This is true whether the nitrates are atmospherically fixed or obtained otherwheres. In this report, of course, we are primarily concerned with the form of nitrates which is secured from the air, as the other forms have been longer used and more fully understood. There are three great sources of commercially used nitrates. First in tonnage is Chilean nitrate; then the ammonia secured as a by-product from coke ovens; and finally atmospheric nitrogen, which until recent years has been a dream of scientists but is now very practical, and is rapidly forging ahead in the tonnage produced. To these three may be added a fourth source, which is the use of legumes in fixing atmospheric nitrogen and which farmers are coming more and more to value. This is nature's way of taking fertilizer out of the air and placing it in the soil in tubercules on the roots of legumes. Man has recently learned how to do the same thing mechanically and chemically.

In the fixation of atmospheric nitrogen, either for military or agricultural purposes, several steps are necessary before we have a commercial product. In order that there may be a clear understanding of the process used in nitrate plant No. 2 at Muscle

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Shoals, an effort will be made herewith to detail in nontechnical and comprehendable terms the various stages in the process.

1. Lime rock is burned into lime and mixed with dried coke which has been finely powdered.

2. This mixture is melted together in electric furnaces which generate a heat exceeding 1,500° C. The product of these furnaces is known as carbide, which is the same product that is used in all acetylene lighting plants.

3. The carbide after cooling is ground through various machines until most of it will pass through a screen having 200 meshes to the square inch.

4. Air being formed of a mixture of nitrogen and oxygen, and only the nitrogen being needed for this process, the two gases are separated, first, by compressing and cooling the air until it becomes liquid, then distilling this liquid to separate the two gases much in the same way that alcohol is separated from water in making spirituous liquors.

5. This nitrogen is then blown gently through ovens in which the powdered carbide has been heated electrically to a white heat, and the result is that the carbide catches or fixes the nitrogen in a manner very similar to the "soaking up" of water sprayed into a box of sand.

6. Now we have lime nitrogen (cyanamid), which is the first form of air-fixed nitrogen either for military or agricultural uses. It carries about 21 per cent fixed nitrogen, and is directly available as a fertilizer but has some limitations in its use.

7. The lime-nitrogen after being ground to a fine powder is treated to a bath of steam and a weak alkali, under pressure of about 150 pounds to the square inch. This causes a gas to be formed known as ammonia.

8. About half of this ammonia gas is mixed with air and by being passed through an electrically heated platinum gauze the gas-air is heated to 600° C. When this superheated mixture is suddenly subjected to a low temperature it begins to change to nitric acid, much as the moisture in a cloud condenses into rain drops when struck by a cooling wind. The cooling process is continued until all the ammonia is changed into a 50 per cent nitric acid.

9. The other half of the ammonia gas is then forced into tanks which old the nitric acid and is absorbed by the acid. This gives us ammonium nitrate in liquid form. This process is comparable to the method of making carbonated water in which a gas is forced into the water and held there.

10. This liquid ammonium nitrate is subjected to heat, and evaporation removes all the liquid, leaving a pure ammonium nitrate which when cooled in revolving pans in which there are stirring paddles, gives us a grained powder not unlike sand in appearance and which carries 35 per cent of nitrogen. We all know that sorghum when subjected to the proper heat for too long a time crystallizes into sugar. A very similar crystallization process happens in the case of this liquid ammonium nitrate.

11. If sulphuric acid is substituted for nitric acid in the process described under paragraph 10, we will have ammonium sulphate instead of ammonium nitrate. Sulphuric acid to use in the production of ammonium sulphate can be purchased or made in the plant. When the Government plant at Nashville, Tenn., for the production of explosives was disposed of at the close of the war part of its equipment for the production of sulphuric acid was retained and shipped to Muscle Shoals and is now available for installation at nitrate plant No. 2 if it is found necessary to do so.

12. Either one of the above-named products is readily adaptable to fertilizer uses.

COMMENT OF THE COMMITTEE.

1. Your committee desires to suggest that in dealing with the whole proposition of manufacturing nitrates for military or agricultural uses the location of the plant is of prime importance. Nitrate plant No. 2 at Muscle Shoals, in connection with the Wilson Dam, has the following remarkable list of advantages in location:

(*a*) Practically inexhaustible quarries of the purest lime rock are easily accessible. The present quarries are only 28 miles removed.

(*b*) Coke, which, combined with burned lime, in the early stages of the process used at nitrate plant No. 2, is produced in large quantities in the coal fields of Tennessee and can be transported quickly to Muscle Shoals. The greatest coke-coal beds in the nation lie between the Tennessee and the Ohio Rivers.

(*c*) The greatest deposits of raw phosphate rock in America are in Tennessee, which adds the possibility of using phosphate rock in electric furnaces and producing phosphoric acid and available phosphates as well as nitrates.

(*d*) Coal beds of immense proportions almost surround Muscle Shoals, all within easy hauling distance. Great quantities of coal are needed to burn the lime rock, as well as to operate the great steam power plant as an auxiliary to the water power.

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There seems to be no need of nitrate plant No. 2 producing its own coke, as this product can be purchased economically from coke ovens already operating. The same statement may be true relative to sulphuric acid in making ammonium sulphate.

(*e*) The Tennessee River is a navigable stream and so offers cheap transportation, both for supplies needed at the plant and for products shipped therefrom, to the whole Mississippi, Missouri, and Ohio River systems.

(*f*) Muscle Shoals is nearly in the heart of the great fertilizer using section of our nation, but is also situated agriculturally somewhat near the center of the whole country.

(*g*) Muscle Shoals is far enough inland to be considered in the safety zone for war time; that is, if an invading army should land on the Gulf shore, the distance to Muscle Shoals is so great that this plant would be comparatively safe, and could continue making nitrates to repulse the enemy.

(*h*) With the immense water power development incident to the completion of the Wilson Dam, there is a certainty that much of the electrical power can be sold for industrial uses other than operating nitrate plant No. 2. Within easy transmission distances of Muscle Shoals lie the metropolitan centers of Birmingham, Ala.; Memphis, Tenn.; and Chattanooga, Tenn., not to mention others of considerable importance. The great coal operations of this territory may be expected to become users of electric current too.

2. It will be permitted the committee to remark that the cheapness of any fertilizer depends to a very large extent upon the ease and simplicity with which it is manufactured, and that the more frequently it is handled or treated in the process of manufacturing the more expensive it becomes. Consequently, the cheapest fertilizer which is capable of being produced at Muscle Shoals is the lime-nitrogen (cyanamide). This product is a good nitrogenous fertilizer when used by itself, but carries much more nitrogen than the usual mixed fertilizer and must be used carefully. When only a nitrogenous fertilizer is needed, lime-nitrogen gives as good results as are secured by any other form of nitrogen, but is somewhat slower in its availability. However, in mixed fertilizers the lime-nitrogen, if used in too great quantities, causes the phosphates to become less soluble, and hence less available as plant food, on account of the lime reacting unfavorably on the phosphates. It is fair to state, though, that the chemists seem nearly to have a treatment for the lime-nitrogen which will remove this undesirable characteristic. It is entirely to be expected that with further experiment these difficulties will be entirely overcome.

When lime-nitrogen is advanced through its subsequent stages and is changed into ammonia gas, then to nitric acid, and finally into ammonium nitrate, or ammonium sulphate it can be readily used, either alone or in mixed fertilizers. All these later stages, as above stated, increase the cost of the nitrogen content of whatever product is manufactured.

3. In this report but little mention will be made of nitrate plant No. 1. The process designed to be used in that plant is entirely different from the one in No. 2 and although it is comparatively a simple chemical process the mechanical difficulties have been such as to offer great difficulties to a practical operation of the plant. Your committee desires the permission to suggest, however, that its faith in the ability of our chemists is so great as to justify us in holding nitrate plant No. 1 intact ready to operate when the difficulties shall have been overcome. Accordingly, you will note in one of the two definite recommendations at the end of this report that your committee has incorporated both nitrate plants in the same recommendation.

IV. Necessity for an Increased Nitrogen Supply.

The world's supply of nitrogen comes from two great classifications, the organic and the inorganic. The organic nitrogen is supplied by such commodities as tankage, dried blood, and cottonseed meal. These products are rapidly being transferred from the fertilizer field to the stock-feeding industry. It has developed that the feeder of live stock can compete in the purchase of these products much to the disadvantage of the feeder of soils who desires to use them as fertilizers. Their use as fertilizers is rapidly ceasing, but a constant increase is noted for these products as stock food. So we may as well not consider these organic nitrogenous products in summing up our available fertilizer supply. Their use is comparatively negligible as plant food.

Our inorganic nitrogen comes almost wholly from three sources. First in importance as measured by the tonnage used is the Chilean nitrates. Next in tonnage produced comes the coke ovens from which a form of nitrogen is secured as a by-product. In recent years, a third source has been developed in the fixation of atmospheric nitrogen. The development of methods, especially the lime-nitrogen or cyanamid process for fixing, or capturing, the nitrogen that is in the air, has assumed such importance in

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recent years, not alone in our country but in several other nations, as to justify statement that the world's increasing demand for nitrates in industry, for mil purposes, and in agriculture will be met largely by the fixation of atmospheric nitr

A review of the present situation as regards the Chilean nitrates and the by-pro from the coke ovens will serve to confirm the statement just made. In the p between 1913 and 1920 the production of Chilean nitrates increased only about 2 cent, although the whole world was seeking nitrogen. This may be accounte partly, by the falling off of the nitrate content in the Chilean product which req the handling of a much larger tonnage of the raw material to satisfy the world n The available nitrogen in the Chilean product has dropped from nearly 30 per where it was in former years to less than 20 per cent now. This signifies, no d that the best beds of the nitrate deposits have been used. Also, it may seem inaccessibility of the remaining beds makes production much slower than was for the case. Whereas a laborer years ago was able to produce more than 70 tons per now the same laborer is producing approximately 55 tons.

The production of nitrogen as a by-product from coke ovens is altogether depe upon the growth of the steel industry. Coke is produced primarily as an adju the production of steel, and can not profitably be produced in quantities in exc the requirements of the steel furnaces. In other words, it can not be produced si for its by-products which are nitrogen, tar, gas, and oil. Somewhat more than ha coke of our country is produced in ovens which can save the by-products, but th fashioned bee-hive coke ovens are not being superseded although they produce no but the coke, and do not save the by-products. This may point to the conclusion as more ovens are built, or old ones remodeled, the determining factor in their ope is the production of coke and not the by-products. So we should not expect the industry to lead out in nitrogenous production when its development is depe upon the growth of another industry—steel. The increase in the productio nitrogen from these coke ovens in the period between 1913 and 1920 was slightly than 19 per cent.

But the statistics as usually given representing ammonium sulphate produ from the by-product coke ovens do not state the exact conditions from the fert standpoint. To look at the statistics one might think that in 1918, for instance, were produced 408,237 tons of ammonium sulphate available for use in agricul This is by no means the case, for this figure represents the amount of sulphate o monia that would have been produced in 1918 if all the ammonia in all forms tha obtained from the by-product ovens had been made into ammonium sulphate. facts are that nearly half of this amount given as ammonium sulphate is never a able for agriculture. In 1918 the actual production of ammonium sulphate 218,194 tons, according to the United States Geological Survey report. As a ge average, 45 per cent of the so-called ammonium sulphate represents simply the duction of ammonia in gaseous form, which is absorbed in water and is sold as ammonia for refrigeration and other industrial and domestic purposes and is made into ammonium sulphate at all. The demand for ammonia in this form i first by the by-product coke ovens and what is left after these industries have provided for is converted into ammonium sulphate and sold as a fertilizer ingre In other words, the ammonia product of the coke ovens seeks the refrigeration than the fertilizer market.

In opposition to the slow growth of nitrogen production in the Chilean nitrate in coke ovens it is significant to note that for the years 1913 to 1920 the producti atmospherically fixed nitrogen enjoyed a growth of approximately 783 per cen is also worthy of note that the world took all this nitrogen and asked for more. may confidently expect the use of nitrogen in fertilizers, in ammunition, and i dustry to constantly expand. This expansion will be measured largely by the of the nitrogen sold. If it can be manufactured and placed on the markets che and cease to be—as it now is—the determining factor in the price of all mixed fertil we may look forward to a multiplied use of nitrogen. Farmers know that their c tions are rapidly depleting our soil of nitrogen, and they willingly would replac ingredient in the soil if it could be had reasonably. A reasonable estimate o annual nitrogenous loss from our soils will be between three and four million to balance which we had in 1920 a total world's production of nitrogen of only on one-half million tons, not all of whcih was available for us, of course. To feed the and to make at least a temporary profit in farming, we must continue to min soils until we can mine the air and take from it cheap nitrogen.

In view of the probable insufficient supplies of nitrogen from Chile and from th product coke ovens, it is somewhat alarming to know that our consumption of nit is doubling every decade. Whether this increase can be maintained—and it c accelerated under the most favorable conditions for producing and marketing nitrogen—depends almost wholly upon the development of the air-fixation ind

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COMMENT BY THE COMMITTEE.

By way of suggesting conclusions, your committee calls attention to these pertinent facts:

(*a*) That the world is running behind in the production of nitrogen.

(*b*) That the price of Chilean nitrate is increasing as its supply becomes more inadequate.

(*c*) That the United States alone paid in 1919, $85,000,000 for Chilean nitrate.

(*d*) That the United States has paid, including 1919, altogether for Chilean nitrate, plus freight, insurance, etc., approximately $800,000,000.

(*e*) That this vast expenditure justifies us in seeking other sources of nitrogen.

(*f*) That nitrogen either by itself or in mixed fertilizers should be placed on the market at a valuation which is not so nearly prohibitory of its use.

(*g*) That to secure a lessened valuation in nitrogen it must be taken from the air, where it is inexhaustible.

(*h*) That since only about 55 per cent of our estimated total consumption would be produced by our own nitrogen plants of all descriptions, including Nitrate Plant No. 2, there is only a remote possibility of overproduction for the present decade.

(*i*) That the by-product coke ovens are not to be considered as primarily producers of fertilizer ingredients, because, first, their production depends upon the steel industry; and, secondly, their products are sold as much as possible in the form of aqua-ammonia, and the remainder only as ammonium sulphate.

V. Costs and Estimates.

(A) NITRATE PLANT NO. 1.

3 large buildings	$7,195,496.71
13 smaller buildings	2,270,413.97
Railways, land, walks, village, etc	3,788,661.05
Total	13,254,571.73

(B) NITRATE PLANT NO. 2.

Approximate total expenditures		69,026,833.43
Overhead, Air Nitrates Corporation		3,504,628.14
Construction fees, Air Nitrates Corporation, including unpaid balance		1,500,000.00
Temporary buildings		4,260,550.00
Chemical plant		37,842,899.98
Power plant		10,436,337.05
Land for plant reservation site		237,711.00
Permanent housing		2,767,837.36
Reservation site and public works		1,427,162.47
Community and commissary activities	$9,411,528.79	
Less cash revenues (miscellaneous and commissary)	4,922,779.69	
		4,488,749.10
Quarry		715,494.65
Operation		1,860,463.60
Total		69,026,833.43
Less operating expenditure		1,860,463.60
Construction expenditure		67,166,369.83

(C). THE WILSON DAM.

Various estimates have been offered as to the total cost of this dam, but as conditions relative to cost are changing so rapidly it is impossible to secure great accuracy. Two estimates are herewith submitted. The first one is based on conditions as they were in 1919 and is being held on that level in order to be definitely sure that the final cost can not exceed the figures given. The second estimate is based on conditions as they were in 1916, but there has been added in each item a 100 per cent increase in the hope that such an arbitrary increase will approximately represent the difference in the cost factors in the year 1916 and at the present time.

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(A.)

Allotted for construction as per national defense act of 1916	$13,160,000.00
Transferred from armament and fortification fund, June, 1920	4,000,000.00
Total allotments to date	17,160,000.00
Total approximate expenditures and commitments to date	16,650,000.00
Amount to be asked from Congress	10,000,000.00
Approximate total cost (based on 1919 conditions)	50,000,000.00
Amount properly allotted to navigation purposes	4,500,000.00
Net cost for power purposes	45,500,000.00
Production cost, 1 horsepower per year (based on average horsepower 300,000, and a 10 per cent interest and operating expense)	15.00

(B.)

General engineering and office expenses	2,275,000.00
Camps, general plant, railroad constructions	2,212,000.00
The dam proper	4,127,000.00
Locks	1,064,000.00
Substructure of power house and tailrace	2,000,000.00
Flowage damages	350,000.00
Road changes	30,000.00
Clearing	76,000.00
Head gates	135,000.00
Racks	68,000.00
Cranes	50,000.00
Generating equipment	4,200,000.00
Cables and wiring	150,000.00
Total	16,737,000.00
100 per cent increase	16,737,000.00
Total cost of dam	33,474,000.00
Amount properly allotted to navigation purposes and not useful for power	4,500,000.00
Cost of dams for power purposes	28,974,000.00
Production cost of 1 horsepower per year (based on average horsepower 300,000, and a 10 per cent interest and operating expense)	9.66

NOTE.—One horsepower at Niagara Falls sells at $17 per year.

(D) MANUFACTURING COST OF CALCIUM CYANAMID (LIME NITROGEN) AT UNITED STATES NITRATE PLANT NO. 2.

[Based on a two-weeks' run with steam power.]

Item.	Two weeks' test at approximately 20 per cent capacity, production 1,450 tons; cost per ton of lime-nitrogen.			Estimated cost of manufacture at 100 per cent capacity, production 222,200 tons per year.			
	Quantity per ton lime-nitrogen.	Unit cost.	Cost per ton of lime-nitrogen.	Quantity per year.	Unit cost.	Total yearly cost.	Cost per ton of lime-nitrogen.
Limestone.....tons..	2	$2.25	$4.50	388,900	$1.25	$486,000	$2.19
Coke.....do....	.54	9.75	5.26	120,000	6.00	720,000	3.24
Coal.....do....	.26	4.25	1.10	46,700	4.00	187,000	.84
Electrodes.....pounds..	44	.06	2.64	8,400,000	.05	420,000	1.89
Power.....kilowatt hours..	2,765	.00738	20.40	624,000,000	.0042	2,496,000	[1] 11.23
Miscellaneous materials and supplies			2.75			591,000	2.66
Labor			11.35			1,600,000	7.20
Total			48.00			6,500,000	29.25
Overhead			13.85			411,000	1.85
Total			61.85			6,911,000	31.10
Royalties per present contract			2.56			1,533,000	6.90
Operating fee per present contract			3.12				
Total			67.53			8,444,000	38.00

[1] When the Wilson Dam is complete, the cheaper water power will be avilable. If we assume this to cost $0.00075 per kilowatt hour, the cost of cyanamid fertilizer will be reduced to $30.85 per ton. It should be noted that the power cost of $0.00075 per kilowatt hour used in this and the following tables is not as large as will be placed upon the power which is sold, but represents approximately what may fairly be charged against the nitrate plants for power.

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One ton of lime nitrogen when oiled and hydrated produces 1.10 tons of commercial cyanamid.

Cost of 1 ton commercial cyanamid ($38 divided by 1.10)	$34.55
Cost of oil and oiling	.75
Bagging	1.75
Research and main office	2.10
Total, commercial cyanamid	39.15

(E) MANUFACTURING COST OF AMMONIUM NITRATE AT UNITED STATES NITRATE PLANT NO. 2.

[Based on a two weeks' run with steam power.]

Item.	Two weeks' test at approximately 20 per cent capacity, production 950 tons; cost per ton of nitrate.			Estimated cost of manufacture with lime nitrogen plant running 100 per cent capacity, 20 per cent of the product being convetred into 22,000 tons of nitrate.			
	Quantity per ton ammonium nitrate.	Unit cost.	Cost per ton of ammonium nitrate.	Quantity per year.	Unit cost.	Total yearly cost.	Cost per ton of nitrate.
Limestone.....tons..	4.04	$2.25	$9.08	77,780	$1.25	$97,200	$4.42
Coke.....do....	1.09	9.75	10.62	24,000	6.00	144,000	6.54
Coal.....do....	.53	4.25	2.22	9,340	4.00	37,360	1.70
Electrodes.....pounds..	89	0.06	5.34	1,680,000	0.05	84,000	3.82
Power.....kilowatt-hours..	5,945.00	.00738	43.87	133,270,000	0.004	533,080	24.22
Miscellaneous material and supplies			11.36			266,000	12.08
Labor			34.73			509,000	23.14
Total			117.22			1,670,640	75.92
Overhead			40.38			100,000	4.56
Total			157.60			1,770,640	80.48
Royalties per present contract			6.27			254,900	11.55
Operating fee			5.00				
Total			168.87			2,024,640	92.03
Bagging							2.00
Research and main office							5.63
Total							99.66

NOTE.—When the Wilson Dam is complete, the cheaper water power will be available. If we assume this to cost $0.00075 per kilowatt-hour, the cost of nitrate will be reduced to $80.05 per ton.

(F) MANUFACTURING COST OF AMMONIUM SULPHATE AT UNITED STATES NITRATE PLANT NO. 2.

Based on a two-weeks' run with steam power. Estimated cost of manufacture with lime nitrogen plant running 100 per cent capacity; 40 per cent of the product being converted into 86,000 tons of sulphate.]

Item.	Quantity per year.	Unit cost.	Total yearly cost.	Cost per ton of sulphate.
Limestone.....tons..	155,560	$1.25	$194,450	$2.27
Coke.....do....	48,000	2.00	288,000	3.35
Coal.....do....	18,680	4.00	74,720	.87
Electrodes.....pounds..	3,360,000	.05	168,000	1.96
Power.....kilowatt hours..	255,482,400	.004	1,022,000	11.89
Sulphuric acid	82,600	10.00	826,000	9.60
Miscellaneous materials and supplies			447,500	5.20
Labor			1,033,000	12.01
Total			4,053,670	47.15
Overhead			198,000	2.30
Total			4,251,670	49.45
Royalties per present contract			582,000	6.77
Total for 86,000 tons of ammonium sulphate			4,833,670	56.22
Assuming 65 per cent would be shipped in bulk, the cost of bagging the remainder prorated is estimated at				.50
Research and main office				3.41
Total				60.13

NOTE.—When the Wilson Dam is complete, the cheaper water power will be available. If we assume this to cost $0.00075 per kilowatt hour, the cost of sulphate will be reduced to $50.58 per ton.

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(G) ESTIMATED COST (EXCLUSIVE OF INTEREST CHARGES) OF PRODUCING PHOSPHORIC ACID BY THE ELECTRIC FURNACE METHOD, ASSUMING POWER AT 325 PER HORSEPOWER-YEAR.

Items.	Quantity (tons) "mine run."	Cost of material per ton Tennessee.	Cost per ton of acid (P_2O_5) raw rock.	Quantity (tons) "washed."	Cost of material per ton Tennessee.	Cost per ton of acid (P_2O_5) raw rock.
Phosphate rock				3.32	$7.00	$22.24
Phosphate matrix	3.73	$1.50	$5.40			
Sand	1.50	.50	.75	1.50	.50	.75
Coke	.75	4.50	3.37	.75	4.50	3.37
Operating expenses: Electrodes, $2.13; labor, $4.45; power, $44.01			50.59			50.59
Total cost per ton			60.11			76.95
Total cost per pound			.03+			.04–

NOTE.—When we assume power to cost $0.00075 per kilowatt hour ($0.0005325 per horsepower-hour) and use this cheaper hydroelectric power, the power item will stand at $4.92 per horsepower-year instead of at $25, as is used in the above table, which is approximately the commercial rate for power. This will reduce the operating expense for power as estimated above from $44.01 to $8.66 and give a total cost per ton for "mine run" of $35.85 and for "washed" of $41.60; or per pound of $0.01767 and $0.0208, respectively.

The estimates in the table given above are all based on a ton production of P_2O_5. To transfer these estimates into terms of 16 per cent acid phosphate it is necessary to remember that there are only 320 pounds of P_2O_5 in a ton of acid phosphate. By taking the pound costs in the table and multiplying them by 320 we ascertain the cost of 16 per cent acid phosphate, which will give us for the "mine run" $9.60 and for the "washed" $12.80. With power from the hydroelectric installation, these prices further reduce to $5.65 and $6.65, respectively, per ton of acid phosphate.

The figures in the above table and notes constitute what will doubtless be a very spectacular development relative to fertilizer prices.

(H) ESTIMATED SUPPLY AND CONSUMPTION OF NITROGEN FOR 1924 AND 1930, IN TONS OF PURE NITROGEN.

	1924	1930
Estimated peace-time consumption in—	*Tons.*	*Tons.*
Agriculture	172,000	285,000
Industries	120,000	150,000
Military explosives	2,500	3,000
Total consumption	294,500	438,000
Estimated domestic supply from—		
By-product coke ovens	122,500	159,500
Privately owned fixed nitrogen plants		25,000
Total domestic supply	122,500	184,500
Deficiency in domestic supply if Government plants do not operate	172,000	353,500
Estimated supply from Government fixed nitrogen plants	45,000	55,000
Deficiency in domestic supply if Government plants operate	127,000	198,500
Estimated imports necessary:		
Canadian lime-nitrogen	15,000	15,000
Chilean or European nitrate, if Government plants not operated	157,000	238,000
Chilean or European nitrate, if Government plants operated	112,000	183,500
Proportion of total consumption furnished by domestic supply—	*Per cent.*	*Per cent.*
If Government plants not operated	41.6	42.2
If Government plants operated	56.9	54.7

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(I) NITROGEN IN RED CLOVER AND COWPEAS.

[Reference: Delaware, A. E. S.; New York, A. E. S.; Mississippi, U. S. D. A.; Indiana, A. E. S.]

1	2	3	4	5	6
Crop.	Condition of crop.	Nitrogen in pounds per acre.			
		Whole plant.	From air.	Roots and stubble.	Fixed in soil (per acre).
Red clover	Mature	103.00	68.60	33.20	[1] 1.20
Do	do	103.40	68.90	40.30	[2] 5.80
Mammoth clover	do	146.00	97.30	78.40	[2] 29.70
Cowpea	do	69.70	46.40	25.30	[2] 2.00
Do	do	112.90	75.20	16.70	[1] 21.00
Total		535.00	356.40	193.90	[2] 15.30

[1] Pounds of nitrogen fixed in the soil.
[2] Pounds of nitrogen taken from the soil.

NOTE.—The sum of columns 4 and 5 when compared to column 3 gives the amount of nitrogen fixed in the soil, or taken from the soil in growing the plant. It seems that not all clover and cowpea fields enrich the soil by chemical action. No figures are available in this connection relative to alfalfa. The average yield per acre of alfalfa hay in the United States for 1920 was 2.74 tons. This hay analyzes 2.3 per cent of nitrogen, which gives us 0.063 ton of nitrogen, or 126 pounds in each ton of alfalfa hay. How much of this is drawn from the air and how much from the soil has not yet been definitely determined. The average yield per acre of red clover hay in the United States for 1920 was 1.45 tons. This hay analyzes 2 per cent of nitrogen, which gives us 0.029 ton of nitrogen, or 58 pounds in each ton of red clover hay. It would seem, from the above table that many red clover fields are drawing upon the nitrogen reserves of the soil instead of adding thereto.

(J) WATER POWER AT MUSCLE SHOALS.

[Based on flowage records of 19 years.]

Horsepower in stream.	Months available.	Horsepower used and wasted with--					
		4-power units.		10-power units.		18-power units.	
		Used.	Wasted.	Used.	Wasted.	Used.	Wasted.
100,000	12	100,000	.....	100,000	.....	100,000	0
240,000	9	120,000	120,000	240,000	.....	240,000	0
360,000	7	120,000	240,000	336,000	24,000	360,000	0
480,000	5½	120,000	360,000	336,000	144,000	480,000	0
600,000	4	120,000	480,000	336,000	264,000	600,000	0

NOTE.—The first four units are to be of 30,000 horsepower, but all others are to be rated at 33,000 horsepower.

(K) ROYALTIES.

Product.	Royalty to—		Total per ton.
	Air Reduction Co.	American Cyanamid Co.	
Commercial lime nitrogen	$0.522	$5.753	$6.275
Ammonium nitrate	1.16	10.395	11.555
Ammonium sulphate	.594	6.176	6.770

NOTE.—Although most of the patent rights on methods and devices for fixing atmospheric nitrogen are owned by the American Cyanamid Co., some are owned by the Air Reduction Co. This makes it necessary to pay two royalties. These royalties are now subject to arbitration, however.

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(L) MAINTENANCE OR STAND-BY EXPENSE OF NITRATE PLANTS NOS. 1 AND 2.

	July 1, 1919, to June 30, 1920.	July 1, 1920, to June 30, 1921.	July 1, 1921, to June 30, 1922.
Nitrate plant No. 1	$171,605.58	$80,500.00	$60,000.00
Nitrate plant No. 2	472,642.63	179,476.20	132,000.00

It has been stated by War Department officers that the daily operation of these plants is equivalent to a storage of 150,000 tons of nitrate of soda for explosives. At $50 per ton this represents an investment on the part of the Government of $7,500,000, which, at 5 per cent interest annually, amounts to	$375,000
Storage on 150,000 tons annually	100,000
(Estimated by War Department officials at $129,000.)	
Total for 1922[1]	667,000

[1] Estimated .

(M) WORLD'S PRODUCTION OF FIXED INORGANIC NITROGEN.

[In metric tons of nitrogen.]

Product.	1913	1917	1920	Per cent of increase, 1913–1917.
Chilean nitrate	390,000	392,000	500,000	28
By-product from coke ovens	343,000	364,000	410,000	19
Atmospheric nitrogen (arc, Haber, cyanamid)	85,000	340,000	665,000	783

(N) COMPARATIVE PRICES.

[In tons.]

Products.	Muscle Shoals.		Wholesale 1920 prices.	
	Steam power.	Water power.	Imports.	Domestic.
Lime-nitrogen (21 per cent)	$39.15	$30.85	$65.36	.....
Ammonium nitrate (35 per cent)	99.66	80.05	(1)	.....
Ammonium sulphate (21 per cent)	60.13	50.58	132.67	$110.00
Acid phosphate (16 per cent)	.....	.....	.....	19.50
From mine run	9.60	5.65	.....	.....
From washed	12.80	6.65	.....	.....
Nitrate of soda (Chilean nitrate, 17 per cent)	.....	.....	68.50	.....

[1] Not quoted as fertilizer.

NOTE.—All wholesale prices here quoted are taken from the 1920 Year Book of the Oil, Paint, and Drug Reporter.

VI. THE REPORT OF THE NITROGEN PRODUCTS COMMITTEE OF THE MINISTRY OF MUNITIONS OF WAR OF THE BRITISH GOVERNMENT.

The greatest contribution to the literature relating to the fixation of atmospheric nitrogen that is now available is the report of the committee of eminent Englishmen, 24 in number, who were appointed in June, 1916, to investigate fully all the scientific and industrial problems incident to the creation of a nitrogen-fixing industry in the Empire. This report contains 360 large pages, and is the result of months of painstaking work on the part of the committee. The final report of this committee was made in May, 1919.

It will be of decided value in our study of the Muscle Shoals project to know what conclusions were reached by the nitrogen products committee. Consequently, space in this report is being taken for several quotations from the English document.

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"(A) A large addition to the home output of ammonium sulphate coupled with the increasing competition of synthetic nitrogen products would undoubtedly cause a reduction in its market price, and this would be of advantage to agriculture and to the export trade.

"(B) It appears probable that undertakings of this character would have to receive the support of the Government or be carried out entirely as national projects.

"(C) The main characteristics of the cyanamid process are:

"(*a*) The relatively small power requirements per unit fixed as contrasted to the arc process.

"(*b*) The direct production of a solid nitrogenous fertilizer (lime nitrogen), thus avoiding the costs incurred in all the other established synthetic processes for converting liquid products into a solid marketable form.

"(*c*) The production of a cheaper marketable form of combined nitrogen than is obtainable by any other fixation process.

"(*d*) Its great adaptability as regards the products obtainable.

"(D) There seems no reason why manufacture both of carbide and also of calcium cyanamid (lime-nitrogen), if laid out on a large scale, should not be successful in this country. There are blocks of undeveloped water power in Scotland of sufficient size for the operation of a large factory.

"(E) The market price of a metric ton of combined nitrogen in the United Kingdom prior to the war varied from 66 pounds to 67 pounds (in the form of ammonium sulphate and Chile nitrate, respectively.)

"(F) The synthetic processes can produce a metric ton of combined nitrogen at a cost at the factory of from 20 pounds to 30 pounds.

"(G) The synthetic processes can produce a metric ton of concentrated (93 to 96 per cent) nitric acid for about half the cost of the Chile nitrate retort process.

"(H) The synthetic processes can produce a metric ton of combined nitrogen ready for the fertilizer market, as cyanamid or ammonium sulphate, at a cost at the factory of about or even less than one-half the pre-war market price of combined nitrogen in the United Kingdom.

"(I) A large proportion of the synthetic plant would find an application under peace conditions for the manufacture of nitrogenous fertilizers, either for home consumption or for exportation.

"(J) As compared with the retort process (used in connection with the Chile nitrate) the saving in the running costs over a period of two years would probably cover the initial capital outlay.

"(K) Dealing broadly with the postwar demand, the requirements of agriculture are certain to be much larger than formerly, the imperative need for maintaining and extending the world's production of food, and the vital importance of combined nitrogen for this purpose, having emerged as the salient lessons of the later stages of the war.

"(L) The consumption of combined nitrogen practically doubled in the 10 years before the war. When account is taken of the relative areas under cultivation in the food producing countries of the world, of the pre-war consumption of nitrogenous fertilizers in the most progressive of the agriculture countries, and of the corresponding consumption in the remaining countries, it is abundantly clear that the quantities of nitrogenous manures employed were in many cases below the most advantageous or profitable level. The difficulties experienced during the war period in obtaining supplies already provided a salutary lesson as to the importance of fertilization, and the resulting wider recognition of the value of fertilizers will lead to an increase in the demand for nitrogenous manures in countries where the consumption has hitherto been very small in proportion to the area under cultivation. In the opinion of the committee, the provision of a really cheap supply of fixed nitrogen would lead to a greatly extended consumption of nitrogenous fertilizer.

"(M) There will be also an increased industrial demand for fixed nitrogen. Nevertheless, the total requirements for industry are unlikely to amount to more than a relatively small proportion of the demand for agriculture.

"(N) It is evident that the supremacy of the Chile nitrate industry is already being challenged, and the near future holds out the prospect that ammonium sulphate of synthetic nitrogen products may become the dominant factor in the nitrogen market and govern the price of nitrate instead of following it as hitherto.

"(O) The proved utility of Chile nitrate as a fertilizer, however, is such as to insure its position in agriculture for a long time to come, but the extent of the demand under postwar conditions will be largely determined by the price at which the product can be marketed.

"(P) Other things being equal, however, the preponderating factor in determining the future consumption of combined nitrogen in agriculture will be the price at which

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it is procurable. The possibilities in this direction due to the development of the synthetic nitrogen industry have already been indicated, and in the event of adequate supplies of fixed nitrogen being forthcoming at a price showing even a moderate reduction upon the pre-war figure, the committee is strongly of the opinion that there will be a very substantial increase in the consumption. If, however, the price of nitrogen remains at the level of the present controlled price of ammonium sulphate. the demand is likely to be largely determined by factors such as the prices obtainable for agriculture produce.

"(Q) The committee is satisfied that synthetic processes can at the present time be operated in the United Kingdom upon a sound economic basis and that the undoubted advantages enjoyed by such methods will become more pronounced in the course of time as the result of constant efforts toward improvement.

"(R) The committee is emphatically of the opinion that the national interests demand the establishment forthwith of nitrogen fixation and allied processes upon a considerable manufacturing scale.

"(S) It appears that the question of overproduction which was raised in evidence given before the committee, is hardly likely to constitute a serious factor in the post-war situation.

"(T) A minimum of perhaps 70 per cent of the world's total supplies of nitrate and ammonia nitrogen was utilized in agriculture prior to the war.

"(U) Combined nitrogen (as cyanamid or ammonium sulphate) can be obtained by synthetic processes at a cost, at the factory, which is less than half the market price of combined nitrogen from other sources, pre-war conditions being taken as the basis in each case.

"(V) The world's demand for combined nitrogen appears to double every 10 years. The increased production during the war has not been more than the normal rate of increase during peace."

"(W) As far as the United Kingdom is concerned, nitrogen fixation and allied processes will constitute a new 'key' industry. The committe is of the opinion that the initiation and development of the industry will require the active support of the Government."

COMMENT BY THE COMMITTEE.

1. As an aid in the study of the foregoing quotations, it may be well at this point to explain that there are three processes which are used commercially in the fixation of atmospheric nitrogen. Whether or not one or another of these processes enjoys any particular advantages over the others depends altogether upon several factors that enter into the manufacturing of fixed nitrogen. From a practical and agricultural point of view the cost of the operation, and the consequent market price of the commodity, is always the determining factor, so far as the availability for farming uses is concerned. Then again, the power required necessarily enters into the consideration. That process which requires least power, other things being equal, will naturally be the most favored method of fixing nitrogen. Also the proximity of the plant to its sources of raw material, and their availibility, will assuredly reflect themselves in the ultimate price.

The three processes referred to frequently by the nitrogen products committee are the arc, the Häber (pronounced Haber), and the cyanamid or lime-nitrogen.

The arc process enjoys the distinction of being simple in that it uses the electric arc to force a combination of nitrogen and oxygen, which combination is caught in water, and after treatment in an alkali produces, as a primary product, nitric acid. Air and water constitute the main raw materials in this process. The handicap of the arc process is that it requires such an expenditure of electrical power. Not more than 4 per cent of the electrical energy used is represented in the nitrogen secured. This makes the arc process almost indefensible except where water power to generate the electrical energy is superabundant. Norway is the only country to use this process commercially, which may be accounted for by a study of her immense water power resources.

The Haber process is used mainly in Germany and was her principal reliance for nitrogen during the war. This process is based on securing a highly precise mixture of hydrogen and nitrogen, under great presssure and while subjected to terrific heat. If the mixture of these gases is properly maintained the heat and the pressure are easily controlled and the resulting product of fixed nitrogen is secured. But, however. if too much of one gas is admitted or too little of the other, the chemical reaction is highly dangerous in that an explosion occurs. A war incident may be cited in which the American war planes were bombing a German plant of the Haber variety, and although none of the bombs hit the mark the plant was destroyed on account of the workmen fleeing for safety from the bombs and so leaving the gases uncontrolled for

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half an hour. The principal advantage of this process over any other known process is the small amount of electrical energy required. Approximately only one-fourth the energy is used in this process that is consumed in the lime-nitrogen method, and only about one-sixteenth as much as the arc process demands. Nitrate plant No. 1 was built to use the Haber process but has never produced fixed nitrogen commercially. The committee desires to suggest, though, that if the Germans can do it, so can we; and to suggest further that the difficulties encountered in the successful application of the well-known chemical laws concerned in this process, are mostly of a mechanical nature, now, and we may confidently expect such difficulties to be overcome by the ingenuity of our chemists and mechanics working together.

The cyanamid or lime-nitrogen process has been explained at some length in a preceding division of this report. Suffice it to say that this process, all things considered, is meeting with the most favor all over the world, and is the one used in nitrate plant No. 2.

2. The report of the nitrogen products committee of the British Government accentuates the following conclusions which have been arrived at in this country relative to a development of the nitrogen-fixing industry:

(*a*) That such an industry would have the effect of reducing prices on the nitrogen content of fertilizers.

(*b*) That such an industry would have the controlling influence in the determination of market quotations on fertilizers.

(*c*) That such an industry should receive the support of the Government.

(*d*) That such an industry, at least with our present knowledge of other processes, should be based on the cyanamide, or lime-nitrogen process.

(*e*) That the synthetic processes (arc, Haber, cyanamide) may reasonably be expected to produce combined nitrogen at approximately one-half the pre-war price.

(*f*) That the establishment of such an industry, although expensive, might be expected to amortize the original capital cost in a few years by the saving effected in market prices on nitrogen.

(*g*) That agriculture will use nitrogenous fertilizers in proportions which increase or decrease as the price of nitrogen fluctuates.

(*h*) That agriculture is the biggest user of nitrogen and therefore is primarily concerned in its production at a price which will permit of its use.

(*i*) That the Chilean nitrate industry will continue as a factor in the fertilizer market indefinitely, but that we should place ourselves in position to be independent of foreign supplies, both in times of peace and war.

(*j*) That a plant to manufacture fixed nitrogen can be operated on an economically sound basis.

(*k*) That the nitrogen industry is not of concern only to one group—as the military, the industrial, the agricultural—nor is it of interest to merely one section of our country. But it is a national problem which challenges the interest of all citizens who have regard for public safety in time of war or who desire that soil conservation and food production be safeguarded in order that agriculture and industry may prosper.

(*l*) That there is slight danger of an overproduction of nitrogen so long as the price factor is held constant and equable.

VII. Power.

Enough information has been offered in other portions of this report to show that any plant designed for the fixation of atmospheric nitrogen, which is to be placed on the competitive markets, must have readily and steadily available the cheapest form of power. In war times when low cost of operation was not of prime importance, provided a higher cost expedited our activities, it was possible to contemplate the operation of such plants as nitrate plant No. 2 with power which did not qualify as being the least costly. Accordingly, a giant steam plant was installed to run the plant during the interim between the completion of No. 2 and of the Wilson Dam, it being known that the power from the dam could not be available for perhaps three years after the plant began production. Nitrogen production by steam power is, of course, more costly than by water power, which is true of any other industry that can be hydroelectrified.

In peace times the successful and economical operation of nitrate plant No. 2 for the production of fertilizers depends almost wholly upon the completion of the hydroelectric plant in connection with the Wilson Dam. The whole proposition at Muscle Shoals revolves around the item of cheap power. Without this cheap power it is hardly possible to hope that the production of nitrogen will be secured at a figure low enough to materially affect the market price of fertilizers. All estimates, data, and reports from every country point significantly to hydroelectric power as being the

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determining factor in the manufacturing of atmospheric nitrogen. All other competitive factors, such as the supply of raw materials, their location with regard to the plant, the available market for the product, the chemical and mechanical difficulties, all take places of secondary importance when compared with the one indispensable factor, cheap power.

That there will be an abundance of water power at Muscle Shoals upon the completion of the Wilson Dam is evident when the salient facts connected therewith are considered. The dam, being 100 feet high, will maintain a normal head of 95 feet. The dam and power house are being constructed for the ultimate installation of 18 generating units, each consisting of a water turbine and generator capable of producing 30,000 or 36,000 horsepower. Seventeen of these units are expected to be ready for operation at all times, leaving one out for repairs. These 17 operating units will therefore, have a total normal output of about 600,000 horsepower. The installation plans call for the immediate placing of only four of these units, which will be ample to operate nitrate plant No. 2, as they will produce 120,000 horsepower. It is worthy of note that the installation of only four units will allow much water to flow over the top of the dam unused during most of the year, whereas if 10 units were installed they could operate to full capacity on an average of half the time, which would justify their installation.

These statements are based on the known flow of the Tennessee River at Muscle Shoals during the period from 1895 to 1914 inclusive, with only one year not considered on account of incompleteness in the records. In all that time, 19 years, the lowest the river ever dropped would have produced 85,000 horsepower: but only 6 years of the 19 recorded show a flow at any time so small as to drop below the 108,000 horsepower required to operate nitrate plant No. 2. In these six years the time in which the flow was less than sufficient to produce this required horsepower amounted to 1.3 per cent of the total time. In these times of low flow the steam plant stands ready as auxiliary power, but to keep the power constant for the four units required to operate No. 2 the steam plant would have to be fired up only 1 day out of 60, on an average.

The records of flowage at Muscle Shoals show that for 9 months in the year there will be approximately 240,000 horsepower, for 7 months in the year 360,000 horsepower, for 5½ months in the year, 480,000 horsepower, and for 4 months in the year 600,000 horsepower, making an average of 300,000 horsepower for the whole year.

If we decide to install only the first four power units and be satisfied to make no use of the remaining power we must be content to see much water spill over the dam. If, however, we desire to harness the full force of the stream we will advocate the placing of the entire battery of 18 power units even if it can not be used throughout all the year. These considerations have given rise to descriptive terms to define the amounts of power available at Muscle Shoals. All that power (approximately 100,000 horsepower) which can be depended upon from day to day, year in and out, as the average lowest power available, is known as primarily horsepower. If for one day, or even for one week, as an extraordinary occurrence, the river should drop below this average lowest power line no recognition is given such occurrence in this definition. All other waterpower at Muscle Shoals, from the minimum of 100,000 horsepower to a maximum of 600,000 horsepower, is called secondary power.

As a maximum waterpower development at Muscle Shoals with 18 power units installed we have: 100,000 primary horsepower plus 500,000 secondary horsepower. It needs to be remembered that the primary power does not vary—it is constant—but the secondary power is quite variable.

There is a third power available at Muscle Shoals from the steam plant. This classifies neither as primary nor secondary power but should be considered altogether as auxiliary power. Its use should be to supplement the secondary power as occasion requires.

The immense reserves of secondary power available at Muscle Shoals not to mention the primary power which is just about ample to operate No. 2 constantly, brings to our attention the necessity of finding a suitable market for such excess power. It may not reasonably be expected that such a market will develop instantly. The history of great hydro-electric plants has been that at first there has been an excess of power for the available market; but that soon the demand for power exceeded the capacity of the plants. So it will undoubtedly be at Muscle Shoals. It would be foolhardy in the extreme, no doubt, to expect at once handsome dividends on our governmental investment at Muscle Shoals other than that which comes to all citizens from a satisfactory supply of nitrogenous products.

It would be unfair though, to estimate the cost per horsepower of the Wilson Dam on any other basis other than one that contemplates the eventual use of all power classified above. Undoubtedly, either by direct location of factories or by transmission, all the power that the dam is capable of producing will be utilized. Therefore

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taking the total estimated cost of the dam with its power equipment but without the navigation features (which will be found in detail in another division of this report) and dividing by the maximum power developed we have the following: $45,500,000 divided by 600,000 equals $75, cost of installing each horsepower if all power were used constantly.

Inasmuch, however, as the primary and secondary power do not stand at that high figure all the time, but maintain a mean average of about 300,000-horsepower, the following equation more nearly represents a fair estimate of installation costs per horsepower. $45,500,000 divided by 300,000 equals $150, cost of installing each horsepower, based on average power developed. It will be seen that the initial capital cost of one horsepower at Muscle Shoals compares favorably with the same power when bought in the form of a high grade gasoline engine for use about the barn or in the shop. It is only fair to state, however, that other estimates as to the cost of the dam, exclusive of navigation features, and which are from dependable sources, reduce the figures above used by fully $15,000,000. The estimate here used was made in 1919 at peak prices and is being adhered to as the highest possible cost of the dam.

Moreover, the cost of operation, per horsepower, after the installation is paid for is far less than that of any other kind of plant, not excepting the most economical steam plant. In this connection the great saving in coal that would be brought about should not be overlooked.

COMMENT BY THE COMMITTEE.

Recognizing that the power development at Muscle Shoals as represented by the Wilson Dam equals in importance, though not in expense, the building of nitrate plant No. 2, and fully realizing that No. 2 will be greatly handicapped until the dam is completed; and considering that the dam will meet its first justification for the expense of building it in the operation of No. 2, your committee, therefore, desires most candidly to state its thoughts on the correlation that exists between the two undertakings:

(*a*) First of all, it is desirable that the Muscle Shoals project pay a reasonable return on a reasonable capitalization.

(*b*) Next in importance, no doubt, is the necessity for operating No. 2 by power from the Wilson Dam.

(*c*) Provision should be made for installing at least the major part of the power units so that excess power would be available.

(*d*) If the complete installation of power units is placed then it might be well to suggest that the excess power be disposed of commercially but that in any event the necessities of the nitrate plants for power be met fully before such excess power is sold.

(*e*) There will be enough excess power, however, to return a handsome revenue to the Government.

(*f*) It must not be forgotten that the combined expenditures at Muscle Shoals in the Wilson Dam and nitrate plant No. 2 represent a citizens' investment made for us by our Government. This investment will be of value to all citizens, and consequently, all citizens should desire that the entire project be put on a business basis. The effort should be to make this gigantic undertaking of our Government "pay out." It can only be done by a businesslike administration of its affairs as will be explained in a later division of this report.

VIII. POSSIBILITIES.

In our consideration of nitrate plant No. 2 thus far in this report attention has been focused almost exclusively upon its capacity to produce nitrogenous fertilizers, as lime nitrogen, ammonium nitrate, and ammonium sulphate. In fact, the plant was built as a nitrogen-fixation establishment so that nitric acid and nitrates could be available for the manufacture of military explosives and for use in fertilizers. That in the erection of this great plant Congress had in mind its dual purpose—military and agricultural—is shown by the following quotation from section 124 of H. R. 12766 of the Sixty-fourth Congress:

"The President of the United States is hereby authorized and empowered to make, or cause to be made, such investigation as in his judgment is necessary to determine the best, cheapest, and most available means for the production of nitrates and other products for munitions of war and useful in the manufacture of fertilizers and other useful products by water power or any other power as is in his judgment the best and cheapest to use; and is also hereby authorized and empowered to designate for the exclusive use of the United States, if in his judgment such means is best and cheapest, such site or sites, upon any navigable or nonnavigable river or rivers or upon the public lands, as in his opinion will be necessary for carrying out the purposes of this

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act; and is further authorized to construct, maintain, and operate, at or on any site or sites so designated, dams, locks, improvements to navigation, power houses, and other plants and equipment or other means than water power as in his judgment is the best and cheapest, necessary or convenient for the generation of electrical or other power and for the production of nitrates or other products needed for munitions of war and useful in the manufacture of fertilizers and other useful products."

(A) AMMONIUM PHOSPHATE.

A great development that can be hoped for at nitrate plant No. 2, is the obtaining of available phosphoric compounds from phosphate rock by treating it in the electrical furnace. It will be remembered that limestone and coke are fused into carbide by means of intense heat in the electric furnaces, and this fusion constitutes the first step in the fixation of atmospheric nitrogen. Later steps produced lime nitrogen, and from it is produced ammonia gas. A gas is of no value as a fertilizer as it can not be placed in the soil; it must be absorbed in some liquid to make it available, and later reduced to a solid form of a crystalline nature. In No. 2 this ammonia gas is absorbed either in nitric acid to produce ammonium nitrate, or in sulphuric acid to produce ammonium sulphate. In fact there are several acids that will absorb this ammonia gas. To cite only one more, it may be stated that hydrochloric acid can be used to form ammonium chloride, which is good for fertilizer use. In nitrate plant No. 2, if we desire to go beyond the lime nitrogen or cyanamid product—which is of itself a good fertilizer but with limitations—and produce the usual fertilizer commodities which are generally used, we have to reduce our lime nitrogen to a gas, ammonia, and use that as the base of our further developments. This ammonia gas contains practically all the nitrogen that the lime nitrogen carried, but it, in its turn, has to have its nitrogen fixed or caught as above stated, in liquid form first, through the use of an acid, and then solidified by boiling.

It is, as above set forth, largely immaterial to this ammonia gas which acid is used to absorb or catch it. Heretofore in this report slight consideration has been given any fertilizer question except the purely nitrogenous one. If, however, other acids can be produced in No. 2 which will absorb this ammonia gas, and if these other acids of themselves have fertilizing values, then it will be well to make such slight changes and additions in the equipment as will enable us to produce more than one fertilizer constituent.

By using the same electric furnaces that have been previously described, and by filling them with phosphate rock, coke, and sand instead of lime rock and coke it is possible to produce a very pure form of phosphoric acid which carries 45 per cent of available phosphates. Here again we see the desirability of the location of No. 2 as some of our largest phosphate beds lie in Tennessee not far from Muscle Shoals. This plan has never been tried out in No. 2, and in fact some alterations would need to be made in the equipment; but there has been a six months' test made of this process by the United States Department of Agriculture on a commercial scale. The result of this test, financially, was that on account of high-priced electric power the product of the test cost more than producing acid phosphate by the old and wasteful method of treating the raw phosphate rock to a bath of sulphuric acid. The conclusion, however, seems to be that with hydroelectric power as cheaply as it can be had at Muscle Shoals the process of making phosphoric acid is entirely feasible and practicable.

In the usual way which is now followed in the production of acid phosphate great use is made of sulphuric acid which has no fertilizing value whatever but really has an acidulous effect on the soil. This is also true of the use of sulphuric acid in No. 2 as an absorbent for the ammonia gas to make ammonium sulphate. In both instances we are carrying something along, sulphuric acid, which has no fertilizing value.

A substitution of phosphoric acid which carries a very necessary fertilizer ingredient for the other acids above mentioned, as the absorbent for the ammonia gas, would result in giving us ammonium phosphate, a fertilizer carrying two very valuable soil foods—nitrogen and phosphate. This ammonium phosphate differs from the ammonium nitrate and ammonium sulphate previously described as products of No. 2, in that it carries two fertilizers in one compound instead of one fertilizer in two compounds.

(B) POTASSIUM PHOSPHATE.

It will be seen from the foregoing paragraphs that at Muscle Shoals we have assuredly a plant to produce nitrogen, and also we have the same plant available as a possible producer of phosphate. This gives us two of the three ingredients that usually go to make up the mixed fertilizers which are sold to-day.

In close proximity to the plant at Muscle Shoals there lie great beds of potash shales, many of which contain 4 per cent of potash. It has been experimentally ascertained

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that the substitution of these potash shales for the sand which is used in the production of phosphoric acid in the electric furnaces does not materially interfere with the chemical reaction that produces phosphoric acid, but does produce at the same time a fusion or union of the potash in the shale with the phosphoric acid. This gives us potassium phosphate with phosphoric acid carrying the potash.

The production of phosphoric acid in making potassium phosphate is in excess of the amount needed to absorb the potash and can be united with ammonia, giving ammonium phosphate.

It will be seen, therefore, that in the one plant there is a great possibility for the development of a complete fertilizer output by absorbing the ammonia gas of the lime-nitrogen process and the potash from the shales in phosphoric acid which is of itself a carrier of fertilizer values and then crystallizing the compounds by the application of heat, much like sugar is secured from the juice of the beat

(C) OXYGEN.

In one of the buildings at nitrate plant No. 2, the air is separated into two component gases, nitrogen and oxygen. The nitrogen is used in making lime nitrogen but the oxygen is released and returns to the atmosphere. Inasmuch as this gas is used extensively in factories and shops for welding and similar uses, eventually we may expect that it will be retained and disposed of commercially

COMMENT BY THE COMMITTEE.

Although the making of phosphate and potash fertilizers at nitrate plant No. 2 are herein classified as possibilities, it must be conceded by all that not much remains to be done in an experimental way as most, if not all, the chemical problems have been solved. Their classification as possibilities rather than actualities is accounted for by the fact that No. 2 was built to make lime nitrogen and other forms of nitrogenous products and certain additions to the equipment and perhaps some new construction would be necessary if other fertilizers were made. Whether or not such expenditures will be approved remains in doubt.

Farmers should realize, though, that the plant is abundantly justified if it produces nothing more than nitrogenous products.

That there may be a clearer understanding of the importance of the entire Muscle Shoals project, and especially that the significance of its phosphate development may be fully realized, your committee submits herewith some quotations from an article written in July, 1919, by Doctor Caro, who is recognized in Germany as the leading authority on nitrogen fixation. Doctor Caro was minister of war munitions for Germany at one time.

"Far more dangerous (to the German nitrogen industry) than the competition of Chilean nitrate appears to be the possibility of competition with artificially fixed nitrogenous fertilizers produced in foreign countries.

"The largest of these foreign lime-nitrogen plants is located in the United States in Alabama. Its situation is most excellent. It is connected with the ocean by means of the Tennessee River, which has been made navigable. It is situated at a source of almost constant water power, amounting to 400,000 horsepower, and is right in the midst of a locality where all the raw materials of the lime nitrogen (cyanamid) industry are present in the highest purity and at the very lowest prices.

"Near by are the inexhaustible deposits of high per cent phosphate rock. The possibility, therefore, exists of producing cheaply ammonium phosphate containing roughly 45 per cent of water soluble phosphoric acid and 20 per cent nitrogen.

"To be sure, the United States is in a position to use right there the nitrogen thus produced, amounting to about 130,000 tons per year; nevertheless it will be possible to ship it long distances to places where its phosphoric acid content will be of importance, and hence it will be sure to offer very strong competition to the German fixed nitrogen industry."

IX. CONSERVATION.

Nitrate plant No. 1, nitrate plant No. 2, and the Wilson Dam together constitute what is probably the greatest single conservation activity of our Government. This entire project should be viewed in the same light as is an irrigation project, a forest reclamation activity, or a levee and drainage problem. Its great purpose in peace times is to assist in maintaining our soil fertility, and consequently in the adequate production of food for our increasing millions.

As all other conservation projects are of general interest to all the citizens so is this undertaking at Muscle Shoals. Farmers and military men need not assume to

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themselves all the benefits accruing from an operation of this project. In times of war it will be predominately military in type; in times of peace it will be almost wholly agricultural in character. But at all times it will be of service to all our people to protect and to feed.

When the rapid depletion of our soil resources, especially the nitrogen content, is considered we can not view with complacency the ultimate condition toward which we are advancing agriculturally. An average crop of corn takes from the soil about 3,000,000,000 pounds of nitrogen. A cotton crop of 15,000,000 bales depletes the soil to the extent of one-half billion pounds of nitrogen. Other crops take lesser amounts, but the grand total will not fall below 6,000,000,000 pounds. Of course the alchemy of nature is working all the time in slowly replacing this lost nitrogen, but the process is wholly inadequate to keep pace with the requiremens of our growing crops.

Man is doing a great deal to replace what his crops take from the soil in the form of nitrogen by growing legumes, by spreading manures, and by using fertilizers. But his efforts do not more than half restore the nitrogen that the soil loses yearly. More nitrogenous fertilizers at a cheaper price would assist wonderfully in checking this soil depletion.

COMMENT BY THE COMMITTEE.

In 1920 the average yield of red clover hay was, for the whole Nation, 1.46 tons per acre. This hay carried enough nitrogen to yield 0.029 tons per acre, or 58 pounds. If enough of this clover had been turned under by the plow so that all the nitrogen would have been given to the soil, it would have taken approximately 4,000,000 acres to equal the annual ouput of nitrate plant No. 2. Since, however, the sacrfice of all this clover hay, at the price secured on an average for such a product would represent a soil fertility investment of approximately $60,000,000, it can be seen how significant our soil conservation problems are becoming.

X. Recommendations.

In consideration of all the foregoing information, after personally inspecting nitrate plant No. 1, nitrate plant No. 2, the Wilson Dam, the flood area above the dam, and the construction equipment; after advising with engineers and chemists on the sitee of the project; and after submitting the items of costs and estimates herein contained to other engineers and chemists of national reputation, your committee unanimously makes two specific recommendations, as follows:

(*a*) That the Wilson Dam be completed by the Government without undue delay.

(*b*) That since the Government now has the rights, under contract, to produce nitrates by air-fixation processes, the nitrate plants No. 1 and No. 2 shall be placed under the direction of a governmentally owned corporation, which may, at its discretion, operate the plants or maintain them ready for operation, but with strict regulations relative to prices to be secured for commodities in which products of these plants are used.

COMMENT BY THE COMMITTEE.

In connection with the recommendations above set out your committee offer this additional information:

(A) RELATIVE TO RECOMMENDATION.

(*a*) That the work on the Wilson Dam is now only sufficient for maintenance.

(*b*) That such maintenance, or stand-by expense, is too great to be long continued.

(*c*) That work can not be resumed on the Wilson Dam until Congress makes the necessary appropriation, which will be approximately $10,000,000.

(*d*) That the completion of the Wilson Dam is indispensable to a successful and economical operation of the nitrate plants.

(*e*) That since the Federal Government has invested millions of dollars at Muscle Shoals, it is nothing but good business to complete the investment by finishing the Wilson Dam so that the entire undertaking may begin to return service to the people and interest to the Treasury.

(*f*) That if work is too long suspended on the Wislon Dam, much of the temporary preparations for construction will not then be available but will have to be again performed.

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(B) RELATIVE TO RECOMMENDATION.

(*a*) That nitrate plants No. 1 and No. 2 can be operated by the Federal Government as the lessee of patent rights covering the processes used. There is herewith submitted a quotation from the contract which has been signed by the firm owning the patents and the Federal Government:

"The licensor (the firm owning the patent rights) hereby gives and grants to the licensee (the Federal Government) in addition for use and applications exclusively by the licensee in the operation of the aforesaid plants, the rights, license, and privilege to use any and all of the patents, processes, methods and designs embraced in the license hereinbefore granted to the licensee by article 1 hereof, from and after the 1st day of June, 1921, or the date upon which the United States shall cease to be in the present war (whichever date shall last occur) and until the expiration of the United States patents covering the same, upon the following terms, to wit."

(*b*) That the Federal Government must pay a royalty to the firms owning the patent rights on the processes for every pound of nitrogen content that is manufactured in the plants until the patents expire, which will be in most instances in 1931. Continuing the above quotation:

"The licensee shall pay monthly to the licensor for such additional license under this article a royalty, unless and until changed by the arbitration hereinafter provided of 1½ cents per pound of nitrogen content in any and all products manufactured by the licensee at each and every of said plants under and by the use of any of the patents, processes, methods, or designs embraced in the said additional license."

(Then follows provision for arbitration of royalty fees if either party to the contract is dissatisfied.)

(*c*) That the nitrate plants can not be leased by the Federal Government to any private firm, unless indeed it be the ones that own the patents on the processes used.

"The lincensor for use and application exclusively by the United States Government or the aforesaid agent (the representative of the Ordnance Department who signed the contract for the Government) at such plants, has given, granted, assigned and does hereby give, grant, and assign to the licensee the right, license, and privilege to use any and all the processes, methods and designs covered by letters patent of the United States and involved in the manufacture of lime nitrogen (calcium cyanamid), its conversion to ammonia gas and the oxidation of the ammonia to weak nitric acid, etc."

(*d*) That, therefore, your committee could see only three alternatives relative to the disposition of the plants, as follows:

(1) To lease them for operation; which leasing, under the contract, would necessarily be to the firms owning the patent rights, and would give us, as a primary conclusion, that no appreciable lowering of fertilizer prices would ensue.

(2) To keep the plants intact on a yearly stand-by, or maintenance, expense which would be great, ready to produce nitrogen in the event of another war, but suffering all the time an unavoidable deterioration of the present equipment and of its adaptability to the development of new processes, which might reasonably be expected to render us helpless, so far as nitrogen fixation is concerned, in comparatively a few years.

(3) To operate the plants under some sort of governmental machinery which would guarantee a businesslike administration of their affairs.

(*e*) That your committee chose the third method outlined above and wishes at this point to outline briefly its ideas as to the administration of the plants.

Your committee thinks it is a universal conclusion that such establishments should not be dependent upon annual appropriations from Congress but that they should be thoroughly equipped, supplied with the necessary operating capital in the shape of a loan or otherwise, and then directed by a board which should be left free to operate the plants on a business basis.

This board should be the legal head of a corporation, the stock of which is all held by the Treasury of the United States. The members of the board should represent various occupations of our people but each member should be a person of proven business ability. It is preferred by your committee that the members of the board be appointed by the President of the United States similar to the appointment of other Federal boards and commissions. After their appointment, the members of this board should be left free, except with such limitations as are legally necessary, to direct the affairs of the entire Muscle Shoals project as a corporate entity.

The powers of this corporation for which this board acts should be, in the opinion of your committee, generally as follows:

(*a*) To own and operate the entire Muscle Shoals project.

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(*b*) To sell to the United States, to producers, and to others the products manufactured.

(*c*) To regulate the prices obtained for any mixtures in which products of these plants are used.

(*d*) To purchase, lease, or acquire patents, both domestic and foreign, of improved processes.

(*e*) To operate the entire proposition as a business corporation, charging prices sufficient to pay a reasonable dividend on a reasonably estimated capital cost.

(*f*) That your committee does not consider the Muscle Shoals undertaking as it now stands as predominately either an engineering or a chemical problem, as those tasks have largely been performed. It is now, rather, a business problem which is of concern to the people in all parts of the nation.

(*g*) That your committee does not at all favor selling the entire Muscle Shoals project, as has been done with other great war munition plants, some of which cost approximately as much as Muscle Shoals and were sacrified, on time sales, at prices representing about 5 per cent of their construction costs.

(*h*) That after the Government has operated these plants for some time and has acquired, by purchase or otherwise, patent rights on the processes used therein, and has demonstrated fully that the research and practical features justify a continuance of their operation, the matter of leasing or selling them to farmers or others for continued operation would then be of pressing importance, as such leasing or selling could be conducted on a competitive basis which is now impossible, since the Government is only the licensee of patent rights that are owned by others.

XI. Conclusion.

It is hoped that the presentation of the information herein contained will serve to confirm you in the thought that the action of the American Farm Bureau Federation in months past relative to the Muscle Shoals project has been a correct action and should be continued with the guidance of the two recommendations above made.

There is an imperative demand at this time for the initiation of legislation in Congress which will make it possible to complete the Wilson Dam and to operate the nitrate plants. It is urgently requested that you signify your approval of the recommendations of the committee in order that the president of the American Farm Bureau Federation, the legislative director, and the legislative committee may feel authorized to proceed.

Respectfully submitted.

W. G. Jamison,
President Colorado Farm Bureau Federation.
John G. Brown,
President Indiana Federation of Farmers' Associations.
Chester H. Gray,
President Missouri Farm Bureau Federation.

Washington, D. C., May 31, 1921.

The Chairman. In a general way, Mr. Silver, what was the conclusion of this committee?

Mr. Silver. The conclusion of the committee, just to give it to you from recollection, if you don't care to read it——

The Chairman. I would like to have you summarize it——

Mr. Silver. They did very earnestly urge that this matter be completed, and without delay.

Senator Capper. You will find two short paragraphs on page 33 of the report, in large type.

The Chairman. What I am trying to get at is, I want to see if this Farm Bureau Federation changed its mind. Did it?

Mr. Silver. No.

The Chairman. They did not recommend in this report, did they, after they investigated that, Ford's offer to be accepted?

Mr. Silver. No. The Ford offer had not been made then.

The Chairman. No; I understand. In a general way, did they not recommend that the Government retain it and go ahead and itself manufacture the nitrates?

Mr. Silver. The committee recommended that the plant be completed, and we did what we could to urge upon the Members of Congress the importance to agriculture of the completion of the dam and operation of the plant, keeping in mind not only the fertilizer end for the farmer but——

The Chairman. At the time this report was made, Mr. Silver, nitrate plant No. 2 was completed in every detail. The only thing left uncompleted was the dam, which

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is still uncompleted, and is in the same condition now that it was in when this report was made.

Mr. SILVER. Yes. But it is well known to the committee and to the farmers that the steam operation of this plant, wholly steam, is not an economical thing.

The CHAIRMAN. Oh, yes; but you are saying that they recommended that the plant be completed. The plant was completed.

Mr. SILVER. May I read the recommendations here?

"(a) That the Wilson Dam be completed by the Government without undue delay.

"(b) That since the Government now has the rights, under contract, to produce nitrates by air-fixation processes, the nitrate plants, No. 1 and No. 2, shall be placed under the direction of a governmentally-owned corporation, which may, at its discretion, operate the plants or maintain them ready for operation, but with strict regulations relative to prices to be secured from commodities in which products of these plants are used."

That was the specific recommendation.

The CHAIRMAN. Now, I will take that. That is a recommendation that in effect, I think, is carried out in the introduction of the bill which is now before this committee, as I drew that. That recommendation is a recommendation that Congress pass the kind of a bill that I have introduced; but now this same farm federation does not want to pass that kind of bill, but wants to accept Ford's offer. Is not that it? If that is not it, let us get it in a nutshell.

Mr. SILVER. All right. You have largely stated the situation. At the time of this report there was no alternative.

The CHAIRMAN. I understand that.

Mr. SILVER. And, broadly, the farmers believe that the Government should not function where the individual can. They thought they might have to to get this great plant in operation, but when the opportunity presented itself for operation by private capital they embraced that opportunity.

The CHAIRMAN. I am not objecting to their changing. I want to get the truth in the record. That is all I care for. Is it not true that this committee that was appointed by the Farm Bureau went down there and looked it all over and made a very thorough investigation and came back and recommended at that time action similar to that contained in the bill that I have introduced, and that is pending now before this very committee?

Mr. SILVER. That is their specific recommendation.

The CHAIRMAN. That carries it out exactly. I could not do it in better terms than that. Since that time, however, Mr Ford has made his offer, and the Farm Bureau has stated that they want Ford's offer accepted, so they prefer the Ford offer to the method outlined in the bill, I take it, and to that extent they do not ask for the carrying out of the recommendations made in the first report?

Mr. SILVER. They ask for the completion of the dam and the action of Congress necessary to make this a going concern under private operation as a first choice and the Atlanta resolution reserves the alternative. They ask to accomplish the same purpose they originally asked for.

The CHAIRMAN. No; they don't. They asked for Government operation.

Mr SILVER. They ask now for a different instrumentality, but they ask you to accomplish the same purpose.

The CHAIRMAN. Oh, yes: they ask for fertilizer, the same thing when you get through.

Mr. SILVER. And it makes a threefold request; improvement of navigation, water-power development, and fertilizer production. It is threefold.

Senator NORBECK. May I ask, do you believe that when they acted on the Ford recommendation they had a full understanding of what Ford had offered to do?

Mr. SILVEE. When they acted on the Ford resolution there had been, some time before, copies of the Ford tender sent to all our State federations and others of our active people—that is, I mean it was not limited to the offices in the 46 States, but in addition to the Federation itself, there were other copies sent out. I don't know just how many. It was sent out in order that they might have the opportunity to study it. After having studied the proposal I would say here, as I said before the House committee, there was some language that they wanted changed. On the House side the changes were accepted, and I have come here with the belief that the tender has been reprinted to carry the amendments asked for or the qualifying language, so that we start with that premise, that the things that we had in mind that we did ask for are carried in that reprint, and the tender to-day is in the form approved by our people.

Senator NORBECK. Let me go back a little, if you please. When this original report was made, about a year ago, and they recommended that the Government go ahead

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and manufacture the nitrates, were they aware at that time that we had a contract outstanding whereby we agreed to pay a royalty on the nitrate production?

Mr. SILVER. Yes. That was one of the reasons, because they thought that we could, by research, find a process of our own.

The CHAIRMAN. Yes. They say in this report, as I remember it, that there were rights that the Government had, that the Government could manufacture it, but they could not trasfer it to private parties; that if they sold it to private partied they would not be able to use the patents.

Senator NORBECK. The Government was under the same contract, was it not?

The CHAIRMAN. Yes.

Mr. SILVER. If the plant was leased they could not lease the process, but if sold could authorize the use. That is treated in the report.

Senator NORBECK. Did they find at that time, or is it their conclusion, that fertilizers could be produced cheaper at Miscle Shoals than the market would afford otherwise?

Mr. SILVER. Yes. That is their report and belief.

Senator NORBECK. Even operated as a Government institution?

Mr. SILVER. And that has been testified to before the committees of Congress, either this or some other committee, by different ones, and at different times.

Senator NORBECK. You understand that the engineers who have appeared before us have invariably said that it can not be produced at the market price, even with cheap water power, do you?

Mr. SILVER. I am going to ask, when we come to the fertilizer end, you hear Mr. Bower, who will treat with the fertilizer end of it and will give you that information.

Senator NORBECK. Who is Mr. Bower?

Mr. SILVER. He is my assistant, sitting right here at my elbow. He will go into the fertilizer end in a way that I can not, and he will treat that particular phase that is in your mind in a way that I think will be satisfactory to you.

Senator NORBECK. As I understand it, the farmers do favor turning over to Mr. Ford property that cost seventy, eighty, or ninety million dollars, also a hundred year monopoly on the use of the water power, and in addition to that 4 per cent money furnished by the Government, all of which could be capitalized at the outset for possibly $50,000,000. They turn that $50,000,000 over to Mr. Ford on his promise that he will put an indefinite amount of additional money into it, and that he will make fertilizers, if he can made 8 per cent profit, and that he believes he will be able to reduce the price of fertilizers. Is that the situation?

Mr. SILVER. That would be one way of stating it.

Senator NORBECK. Well, is it correct, or is it wrong?

Mr. SILVER. I would not state it quite that way, but take them one at a time. Mr. Ford does agree to make fertilizers, and he does feel as others do and state that he can make cheaper fertilizers, and if you give him the opportunity and somebody else makes them cheaper, the purpose of making cheaper fertilizers has been accomplished. Again, when you talk about the Government extending credit, 4 per cent money, as though that were a special favor, the record of Governmental securities does not show that 4 per cent is cheap money as shown by this list.

Bonds.	Amount issued.	Amount retired.	Amount outstanding
2 per cent consols of 1930	$646,250,150	$46,526,100	$599,724,050
4 per cent loan of 1925	162,315,400	43,825,500	118,489,900
2 per cent Panamas of 1916-1936	54,631,980	5,677,800	48,954,180
2 per cent Panamas of 1918-1938	30,000,000	4,052,600	25,947,400
3 per cent Panamas of 1961	50,000,000		50,000,000
3 per cent conversion bonds of 1946-1947	28,984,500		28,984,500
2½ per cent postal savings bonds, first to twenty-first series	11,774,020		11,774,020

Senator NORBECK. Could a private party finance a dam undertaking like that at less than 7 per cent, counting the allowance for the cost of raising the money, or would it take them 10 per cent?

Mr. SILVER. Senator, you have put your finger on one of the poiuts that is nearest our hearts, namely, that 80 per cent—I could answer that now, but would rather do so later.

Senator NORBECK. If you prefer to answer it later, that is satisfactory to me.

Mr. SILVER. I will come to that later in my statement.

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Senator NORBECK. I just wanted to be sure that you answered it. My opinion is that the public have no more understanding of Mr. Ford's offer than these Senators did, and I say to you that this committee and the committee of Congressmen that visited Muscle Shoals went down there and looked the thing over and came back, and we found that we had never understood Mr. Ford's offer.

Mr. SILVER. That is possible. But the thing we want to do is to arrive at the right conclusion.

If I may, I will follow along, but do not hesitate, at any time that I am not making myself understood, to interrogate me.

Having called your attention to the different interests the farmer has in it, namely, improvement of navigation, further power development and fertilizer production, the farmer is endeavoring to eliminate the arbitrary methods and practices which special interests employ to keep prices high. Such arbitrary conditions are excessive or unnecessary tariffs, trade practices, patent rights, formulas, etc., such as in the production of nitrates there is a tariff asked on the product ammonium sulphate that we hope to be able to produce here cheaper than anybody is producing it in or out of the country.

The CHAIRMAN. What is that?

Mr. SILVER. The nitrate, in whatever form it may be worked out. There is a tariff provision on both sulphate of ammonia and potash, just a possibility, maybe, but at any rate it makes a high cost factor.

The CHAIRMAN. Are the people whom you represent opposed to a tariff on potash?

Mr. SILVER. Yes. We filed a brief to that effect.

The CHAIRMAN. With the Finance Committee?

Mr. SILVER. Yes.

The CHAIRMAN. You realize that even after we get the nitrates we have to have potash in order to make fertilizer?

Mr. SILVER. Oh, yes.

The CHAIRMAN. Nitrate is only one of three important ingredients.

Mr. SILVER. Only one of three important ingredients, yes. The duty on potash is 2½ cents per pound, which very materially increases the price to the farmers in producing their crops.

I will read this:

"Muriate of potash containing 50 per cent K_2O is selling for $35 per ton landed in coast ports. This duty would add $25 per ton to this price at importing cities, to which would be added the profits of mixers, dealers, freights, etc."

That is not only a profit on the goods, but it is also the profit on the tariff, and that affects the price.

The CHAIRMAN. As I understand it, that potash comes from Chile that you are speaking of?

Mr. SILVER. No; this is from Germany and France.

The CHAIRMAN. Oh, yes. It is the nitrate that comes from Chile. The potash is from Germany and from France?

Mr. SILVER. Yes; it may be either.

The CHAIRMAN. Two and one-half cents a pound would mean $30 a ton, would it not?

Mr. SILVER. It is 50 per cent.

The CHAIRMAN. It would be $50 a ton.

Mr. SILVER. No; it would be $25 per ton.

Mr. BOWER. It is 2½ cents a pound on K_2O. Muriate of potash carries 50 per cent K_2O, and the duty is imposed on the potash content.

Mr. SILVER. This duty will cost the farmer from $12,000,000 to $15,000,000, of which the domestic producers of potash will only benefit to the extent of $2,000,000.

The CHAIRMAN. It seems to me it would be interesting right there to know what Mr. Ford was thinking about in the potash line, what effect, if we pass that tariff bill, it will have on his offer?

Mr. SILVER. I am using this as an illustration, just to show you how the high-cost factors affect the farmer, and as I go through my testimony I will try to show you how we can benefit by less-cost factors, and I am using that as an illustration, and it is an illustration you are all familiar with and are acting upon at this time.

The CHAIRMAN. I think it is very pertinent, but the point I want to get at is that while it would not affect Mr. Ford in his getting his nitrates out of the air, it is the completed fertilizer that the farmer is interested in, and he says he expects to produce the fertilizer at such and such a price. If his potash, which constitutes about one-third of the fertilizer, is increased about $25 a ton, it may be that it would completely nullify his proposition.

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Mr. SILVER. It would apply to all alike. It would make fertilizer high, but it would not change Mr. Ford's relation as compared with other fertilizer people.

The CHAIRMAN. It is not in writing, of course, but his representatives say to us, "We are going to cut the price of fertilizer that the farmer has to pay in half." Now, won't this tariff alone prevent him from doing that?

Mr. SILVER. We are protesting against the passage of that paragraph of the tariff bill. Of course we have no way of knowing what Congress, in its wisdom, may see fit to do, nor can Mr. Ford control it.

The CHAIRMAN. I realize that, but the point I want to make is would not that of itself make Mr. Ford's proposition an impossibility?

Mr. SILVER. No; it would not affect Mr. Ford's proposition, because he would have the same relation. I am talking for the farmer. I am not talking for Mr. Ford.

The CHAIRMAN. Exactly; and so am I. But it seems to me you forget the farmer when you say it would not affect his proposition, because his proposition is that they are going to cut the price of fertilizer to the farmer in two in the middle. You say it would not make any difference, because everybody else's price would go up, but that is not quite it. That is not cutting it quite in the middle, at least. It is $50 a ton now, and he is going to make it for $25, and he is going to pay $25 a ton right there.

Senator NORBECK. Go out to the sand hills of Nebraska and manufacture it.

The CHAIRMAN. He can not get it for that price out there, unfortunately. I wish he could, but he can not.

Senator KEYES. I can not understand why you bring it in here as a tariff matter unless it does apply to Muscle Shoals. We are discussing the Muscle Shoals proposition.

Mr. SILVER. I was simply using that as an illustration. When you get to the tariff you get different angles on it. I did not bring it in here as a tariff measure, but simply as an illustration of how the farmer suffered from high-cost factors, and what benefits they get from low-cost factors. I did not intend to provoke a tariff discussion at all.

Senator HEFLIN. The chairman asked him the question.

The CHAIRMAN. It seems to me it has a direct bearing.

Senator HARRELD. If this tariff increases the price of potash, it would increase that price to all manufacturers alike, so relatively it is the same thing.

The CHAIRMAN. That is what he says, but I want to have you or anybody else explain it, because Ford says he is going to cut the present price of fertilizer in two in the middle, and that is what the farmer is interested in. I would like to have anybody show me how it is going to be done if we are going to pay a $25 tariff.

Senator NORBECK. I call your attention to the fact again that he has not given any bond that it will be cut in two.

The CHAIRMAN. The people advocating Mr. Ford's offer are taking his word for it.

Senator HEFLIN. And some of us haven't any notion of voting for the tariff on potash.

The CHAIRMAN. I have not for one, I will say. I have not any notion of voting for it; but I call your attention to the fact that it will be no relief to the farmer when Mr. Ford comes back and the farmer says, "You agreed to cut my fertilizer bill in two, and I was paying $50 a ton, and I am paying $50 a ton yet." Ford says: "That was because of the tariff on there, and it does not affect my proposition, because relatively it was just the same as it was before," which is true, but it has not helped the farmer.

Mr. SILVER. Of course you would still be producing cheaper nitrogen. You would still have the relief that you gain from carrying this 1 ton instead of 5 tons; you would save the cost of four freights; you would save there, although you have lost on the tariff on the potash. There would be economies still possible there. They would be partly offset by the tariff that may be put on potash; it does that much to neutralize the benefits hoped for by the people who are interested in cheap fertilizer.

Senator HARRELD. All of which illustrates the point I made the other day, that if Mr. Ford wants to get out of this fertilizer contract he would find a hundred loopholes to get out of it.

Senator HEFLIN. Not after the contract is drawn.

Senator HARRELD. Under that provision of the contract under which he would be relieved from acts over which he had no control.

Mr. SILVER. Of course, he would have no control over what Congress saw fit to do in the matter of tariff.

I refer briefly to the ammonium sulphate, the proposed duty of $5 a ton, and then, second, the unfair freight rates. Freight rates are high, and to the farmer, compared with the selling price, they are unfair. The division of freight rates, long and short haul, discriminates against him, as was illustrated by some one, probably Senator Jones, who was telling before a committee the other day that the freight from Albuquerque, N. Mex., to Boston on their cotton is around $1,500 a car, and on goods the

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same back; but from Los Angeles it is $1,000 either way. Now, that is a discrimination against those people in that territory where those freights are so made; and that has to do with high-cost factors; not only that, but the fact that all freights are apparently high at this time.

Senator NORBECK. Let us get down to Muscle Shoals. The thing this committee would like to know is whether there is any prospect at Muscle Shoals of reducing the price of fertilizer 1 per cent. If there is we would like to know it.

Mr. SILVER. To my mind Muscle Shoals is not alone a question of Henry Ford's contract or fertilizer; it is the turning point of the development of our natural resources that might have to do with less cost factors.

Senator NORBECK. If it works a certain way?

Mr. SILVER. Yes.

The private selling agreement. To illustrate, the steel business, the Pittsburgh Trust case, where we have paid, under the pooling agreement, phantom freights to the extent annually of many millions of dollars, estimated before the Interstate Commerce Commission some seventy millions of dollars annually that is paid for service that is never rendered, but purely a phantom freight that they collect off of the producers because of their pooling agreement to make the Pittsburgh base. If you set up a new base, like it is possible, if you set up cheap electric power at Muscle Shoals for a new base, we do away with that base and save many millions of dollars in that way. Sixty thousand dollars of phantom freights were paid on the steel in the Federal Reserve Bank Building in Chicago.

The CHAIRMAN. Let us see. I agree with you that that phantom freight on steel is an outrage. I think it is an economic sin, and that almost any Government in the world besides ourselves would almost have a revolution brought about. I can not condemn it in parliamentary language that is strong enough; but you propose here, by starting in at Muscle Shoals, not that you will do away with that principle but that you will establish another base that won't be quite as bad as that, on the same principle, I suppose, that this is established. To get a practical statement of it, if I was shipping steel from Chicago to Omaha, I would have to pay freight, in addition, although the steel might have been manufactured in Chicago and never any particle of it have been east of Chicago, but I would have to pay freight from Pittsburgh to Chicago, would I not?

Mr. SILVER. Yes, sir; that is right as to freights.

The CHAIRMAN. There is no principle of economics on which that can be defended. Muscle Shoals is not going to help that if it fixes another base down there. The principle will be just as bad if we establish another phantom freight rate from Birmingham, Ala., although there may not be quite as much money in it as there would be from Pittsburgh.

Senator NORBECK. It is not violent to assume that cheap power will bring the steel industry there. Is it not only one of the factors in the steel industry, and a very small one at that?

The CHAIRMAN. The point he is making here, in my judgment, has not anything to do with it, because the thing that is wrong about the freight business will be wrong even though the sin may not be quite as great. If he was here advocating Government ownership of railroads and a law abolishing that kind of discrimination, it would be perfectly applicable. What has happened, as a matter of fact, is that the Federal Trade Commission, that wanted to investigate that steel proposition, has an injunction against it now by the United States court prohibiting it from going into the practice of the steel companies in charging that extra freight rate. So we have a question of courts as well as railroads in it.

Senator HEFLIN. I suggest, Mr. Chairman, that we let him go along in his own way and state what he feels will bear upon it. It won't take him very long.

Mr. SILVER. The point in that is that under the production of steel by the electric furnace method certain grades can be produced at about half the cost of the coke-oven methods, if my information is correct, and if we set up the development on that basis others may get on a like basis to compete, and it will be a solution of that problem, once the steel people see fit to go into the field.

Senator NORBECK. I notice that the steel fellows instead of going to Niagara Falls, when that power development was in progress, went to other places. Did they know what they were doing?

Mr. SILVER. The development of electric power on the amortization basis, as provided here, has not been looked upon with favor by those who have been developing water powers, but if in the future it is made dependable by the Government authorizing it, there might be a different light in the location of their plants and securing of their power.

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Senator NORBECK. But the fact remains that the amount of horsepower available in our water falls is quite limited and if you use it for steel you won't have it for washing machines. There are a great many different purposes for which it can be used.

Mr. SILVER. All the industries of the United States use some 31,000,000 horsepower, and all the railroads of the United States, if electrified to-day, would not use to exceed 14,000,000 horsepower, and we have some 70,000,000 potential horsepower, with less than 10,000,000 developed.

Senator NORBECK. Yes; but it is potential and not available horsepower.

Mr. SILVER. Well, but it can be made available.

Senator NORBECK. You make and transmit that horsepower from the Rocky Mountains to the Alleghenies and you won't have much of it left by the time you get to the end of the line.

Mr. SILVER. It is not all in the Rocky Mountains, though, Senator.

Senator NORBECK. No; but there is a hundred times more out there than you can use. That is where the large amount of it is. You would have to move that over to the industrial centers, or over on the railroads in New York, and your loss would be pretty heavy in transmission.

Mr. SILVER. Somebody's report says that if the Potomac River, right here near Washington, were locked and dammed there would be produced more water power than is produced at Niagara Falls. Here we see this going to waste every day without seeming to realize it.

The CHAIRMAN. We can not get anywhere with that. We tried that a great many times, to develop Great Falls out here, but have not been able to do it, because the special interests do not want it developed, and your organization has been unable to help us.

Senator HEFLIN. That comes back to what I said a while ago.

The CHAIRMAN. Even Ford was not bidding for that, so you can not lay that to the fellows who are after Ford's scalp.

Mr. SILVER. I am trying to illustrate the point that with the water powers in the West and particularly where the power is needed, in a great many instances, if it can be developed on the right plan, so as to be of use to the people in an economical way——

Senator NORBECK. Is it not a fact that the majority of the articles that are written on our power development give the maximum development always; that they include the secondary and third and fourth kind of horsepower, instead of limiting themselves to the power that runs throughout the year?

The CHAIRMAN. I think it is probably hardly fair to say that, but it is true that there is the load-factor proposition. In other words, 100,000 horsepower——

Senator NORBECK. Does not mean 100,000 horsepower. There is such a difference between theory and practical application.

The CHAIRMAN. It is not so much that, but you have always to have enough to reach the peak. There is lots of it you do not use. For instance, you do not use it all in the operation of a street railway. It is like operating a street car in Washington. There will be two hours in the morning and two hours in the evening when you would need all the power you had, and the balance of the day you would not need half of it, and still you would have to have the same amount of power there all the time. That is what they call the load factor. You can not utilize if for practical purposes clear up to the limit all the time.

Senator NORBECK. The testimony we have is that the streams of the United States vary so much with the season, that while at times the potential horsepower is very great, at other times it is very weak.

Mr. SILVER. There are many things that have to do with our high-cost factors, secret processes and formulas of different kinds. One of the cases I might mention would be the case of the Selden patent which set out to be a tax on every horsepower developed by internal combustion engines, but it was finally fought and fought to a successful conclusion and that tax was removed, or that cost factor was reduced.

The Gillette razor is another illustration of how under certain patents the high cost factors are maintained, for during the life of the patent on that it was a $5 article, and since the expiration of the patent it is a 65-cent article. Now, all these methods are used to keep costs higher to the people, but if we can start any place to cheapen production we set in motion helpful influences that would have to do with less cost factors.

I use these three illustartions to show you that fertilizer is not the only thing that would be affected. There are other things than fertilizer, for if we make a cheaper cost factor of electricity, which is the most desirable power, and we have abundance of it in our water powers—if we develop them we can not only produce cheaper fertilizers and cheaper steel, but we can manufacture or can fabricate woodenware

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cheaper, steel cheaper, and make our binders, tractors, trucks, etc., cheaper, and we can fabricate wool and cotton cheaper. Many of the things that enter into our everyday life can be made cheaper, if we make cheap raw material of electric current, and my group believes that Muscle Shoals is the place to try it out, to start this new kind of development of these great natural resources, and with one of the greatest manufacturers of all times.

Senator NORBECK. If we turn it over to a millionaire, how will we have anything to say about developing it afterwards?

Mr. SILVER. Under the plan that is proposed in this tender the public maintain their equity. You turn it over to him with conditions, and at the end of the lease period you still have it; it continues your property, and the public enjoy their equity as they go along because of these less cost factors. I am just illustrating the point that while that belongs to the public to-day, and rightly so, if you pledge the public credit, which I think we do too little of, use the public credit and save in the cost—80 per cent of the cost of electricity is interest—if you cut the rate of interest from 8 or 9 per cent to 4 per cent it would about cut in two the cost of the electricity, just that one point, and if you go on and amortize that and pay back in full and use that current for public purposes on the basis of maintenance and depreciation, you have served the public well, and they have maintained their equity and benefit in that natural resource.

The CHAIRMAN. Now, in this case of Mr. Ford's proposition that you are advocating, what is there in his offer that guarantees cheaper electricity, or any of those things? He has not agreed in his offer that he will sell a single kilowatt of that electricity.

Mr. SILVER. He does not need to sell a single kilowatt of electricity for the public to enjoy it, for they can enjoy it by cheaper manufactured articles, if he will produce the things that they need to buy and sell them on a lower basis, because he has lower cost factors, and the public will enjoy the benefit.

The CHAIRMAN. Exactly; but how do you know he is going to do that? Suppose he starts in in the steel production now and makes steel down there, self-binders and plows. His cost factor, because he has got 4 per cent Government money to develop that is entirely lost and he can make it cheaper than the International Harvester Co. makes it in Chicago. Has he, in his offer, anywhere, either directly or indirectly, agreed that he would let any governmental authority say that he ought not to charge too much to the farmer for a binder that he would make, and is there anywhere any guarantee in it that he will not only cut under the International Harvester Co. to enough to make the sale, but that instead of the people getting the benefit of that cheap cost factor, that cheap money that he is getting from the Government, and cheap electricity that he is getting, that he himself will get the benefit, or his corporation?

Mr. SILVER. The fact that he is the head of the corporation is sufficient guarantee that the corporation will have the viewpoint that the public is to enjoy it.

Senator NORBECK. What will we do when he is dead? He wants a hundred-year contract.

The CHAIRMAN. He has agreed that this shall be done by a corporation. He is about as old as I am now. He is not a baby or a child, and if you are going on faith, as you are, and as your own testimony shows, and you are basing it on his reputation for selling things cheap and good, as far as he is concerned, I agree with you most heartily.

Mr. SILVER. You agree with that?

The CHAIRMAN. Yes, sir. It will probably be 5 years before this is completed, and probably 10 years before that machinery is completed. By that time Mr. Ford will be ready to die. I can not expect to live more than 10 years, nor can Ford. We will both be dead. That corporation will be a corporation. How can you fix it otherwise? Tell me how you can fix it so that that corporation can have the soul left in it for the other 90 years of this lease that Ford has in him.

Mr. SILVER. Well, there are two things that arise in my mind when you ask that question. One of them is that his business has been successful, his goods have been produced at less and have been sold cheaper, and we are interested in that, and a corporation as successful as his has been would be slow to get away from that principle.

The CHAIRMAN. What is the difference between that corporation with Ford dead, and J. P. Morgan's Corporation, and what assurance have we that the International Harvester Co. in less than two years after Ford is dead won't own every dollar's worth of that stock. Where is the guaranty for that?

Mr. SILVER. I don't know that there is any guaranty in the way you picture it, but there is this guaranty, and, finishing what I meant to say about that, if that great business were begun on that plan it would likely continue it for no other than the selfish reason that it had been profitable. I think it would continue. And then the

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other reason is that if you give to Mr. Ford on that basis this great water power you will have set a precedent, and you will have others doing the same thing, the International Harvester people and some other corporations. There will be other water water powers. This is only one of fifty, using a figure of speech.

The CHAIRMAN. That argument applies to the International Harvester Co. and every trust corporation in business.

Mr. SILVER. In other words, their own business life would depend upon getting a development of a like kind, and in that way you would get all of them on a lower cost basis, and consequently a lower selling basis to the benefit of all the people.

The CHAIRMAN. All right. Now, suppose Ford does get this, and suppose he dies. He can not expect to live more than two or three years after this is completed, at the very best. He dies and this corporation is there and the International Harvester Co. buys the stock and owns the corporation; do you suppose that because they bought the stock that used to be owned by Ford, they will be moved by his proposition to do better by the farmer than they are doing now with that immense establishment? Is that going to make them good?

Mr. SILVER. No; not as you put it, but if you take as an illustration a water power at a capital cost of $300 per horsepower developed, the cost of horsepower per year would be at the rate of 8 per cent; private development, $24; operation and maintenance, say, $6, making the horsepower cost, which is about the average east of the Rocky Mountains, $30 per year. Now, if, on the question of pledging public credit and getting a less rate of interest, you use, say, 4 per cent on that same capital stock, and have a $12 interest and $6 operation and maintenance, you would have $18 per horsepower year. But if at the completion of the amortization time, when you had no interest and you had your $6 operation and maintenance, you would have your $6 per horsepower per year.

Now, that will illustrate just how to step down in cost, and without any other thing than competition in business and a desire to do business, if they can have that much improvement in their cost, they are going to sell cheaper every time in the absence of pools and secret agreements and trade agreements like I referred to a while ago; and there is water power enough to give all the cheap electric plants that this country has need of for many, many years to come, if it were all put to use.

The CHAIRMAN. But everybody knows that the history of the past, if it repeats itself, will mean that there will be just as many combinations when water powers are built and constructed as there are now without water powers. If the International Harvester Co. is a trust, as we thought it was and as the Supreme Court held it was, without water power, would it be any the less a trust if it had water power and could get its power cheaper? Do you expect some magic to happen because we are going to furnish 4 per cent money for a corporation that a very good man is going to own the controlling interest in for a few years and then have it remain good throughout eternity?

Mr. SILVER. This is not a case of a good man or bad man. This is a case of developing the great natural resource on a better basis than is now used.

The CHAIRMAN. And turning them over to a corporation.

Mr. SILVER. No matter what corporation you turn it over to, good or bad or any other kind, it makes a less cost factor. In the development of water power it has been common and is common to put in as much stock and bonds and preferred stock and all other kinds of securities as they could, and as the earning power increased they continued issuing securities, built on up, and that makes a high-cost factor by the time it gets down to the consumer, and if you take out at least this one margin—that is, the power factor—and put it on another basis, you certainly have helped the people to that extent.

Senator KENDRICK. Now, Mr. Silver, may I ask a question there? Do you think and believe that the cost of production that is involved in the manufacture of different articles to the farmers or industries has very much to do with the price of that article when it is delivered to the man who uses it? Don't you believe that in the majority of cases, stating the question in another way, there is but very little relationship in the cost to the producer of it, the manufacturer, and the cost to the consumer? Your argument is, in effect, if the Government cuts off a large part of the cost in its delivery of this plant to Mr. Ford it will cheapen the cost to the consumer. Is not that it?

Mr. SILVER. Yes.

Senator KENDRICK. Now, my question is, do you believe that, with the majority of manufacturing concerns, that has any bearing on the price?

Mr. SILVER. I grant you when business is going good and prices are easy, and everything is going up, that mostly business depends upon what the traffic will bear, just what they can sell it to the public for; but when less favorable times come, and it becomes a question of who does the business and who keeps going, there is no doubt about it, in the absence of pooling agreements and trust agreements, there is competi-

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tion, and that the industry with the most favorable cost factors is certainly the one that gets the business, or the other meets the competition. They do come down, and if you cut the cost factors—and this is one of the principal ones in all industry—and put them on a less-cost basis, you make possible a less-cost factor of the manufactured or fabricated production to the farmer.

The CHAIRMAN. Now, Mr. Silver, suppose we developed Muscle Shoals according to the first recommendation of your committee after their extensive examination of things, where they advocated development by the Government owning all this property, and the Government retaining the property, following which recommendation I drew and introduced a bill which is now pending and which you and your fellows have now gone back on and changed your opinion in favor of Ford, but suppose we develop it according to your first recommendation, and this cheap power is developed down there by this corporation that I have provided in the bill, and we have the board I have outlined in the bill to safeguard the price, and we have this Government corporation selling the power to Ford or to Morgan or to Harriman or to anybody else, but we exercise the power to say, "We will sell you this power at a cheap price, and you can make steel out of it, but under the law authorizing us to do so we insist that the farmer shall get the benefit of this article when it is completed, and you can not sell it to him above a certain percentage of profit," would not that guarantee that the farmer is going to get the benefit, and through him the people of the United States, of whatever cheap power is developed here? On the other hand, with your proposition to turn it over to Ford on his proposition, and Ford dead, you haven't given us any assurance, and I challenge you to give any, if it is not in his contract, to fix up a contract that will guarantee that the consumer is going to get the benefit. You can't do it.

Senator HEFLIN. His contract does set out, or he offers to set out in the contract, that he will not make over 8 per cent.

The CHAIRMAN. On fertilizer. But there is not a damned thing in there but what he can make a thousand per cent on a plow or a harrow or an automobile or anything that he produces.

Senator HEFLIN. The fact is, Mr. Chairman, that he has made automobiles cheaper than anybody else.

The CHAIRMAN: I have said repeatedly if you will guarantee he will live a hundred years, I am ready to vote for his proposition now. I have faith in him, but I don't believe when he is in heaven he is going to run this corporation here on earth that has not any soul, and you can not, and nobody can, fix up a contract that can make it possible for that to be done. It can't be done. So you are advocating something here for the farmer that, when it comes to roost, although you may be dead, like me, when the time comes you will ride through on this popular move, but eventually it will come home to curse you because you have advocated such a thing, and it is going to bring condemnation, to my mind, on every man that has had anything to do with putting it through.

Mr. SILVER. I can not think or believe that by developing a natural resource on the basis that it does and will benefit the people, you will be in any way bringing a curse on anybody, but on the contrary, a blessing to many farmers in distress at this time.

The CHAIRMAN. No; you won't; but you have assumed again that this will benefit the people. You haven't any assurance that this corporation will benefit the people one iota, and you can not demonstrate it or show it, and that is where the curse comes in. It will be just like any other corporation. It will be owned by somebody else and will be manipulated just the same as the International Harvester Co. has been manipulated and is being manipulated right now, and the farmer will not be helped any.

Senator HEFLIN. They have not been able to eliminate Ford yet.

The CHAIRMAN. Ford is going to die. Who is going to guarantee that he is going to live.

Senator HEFLIN. He will live 15 or 20 years.

The CHAIRMAN. It will be 10 years before this thing is developed. I get tired of men advocating a thing that it seems to me they ought to see, must see, and do see, that this corporation that Ford is going to organize, with Ford controlling it, is not the corporation that is going to operate when Ford is dead. He is 60 years old now, in round numbers. It will be 10 years, at the very best, if this is accepted tomorrow—it will be 20 years before it will be in full operation down there.

Senator HEFLIN. I understand he is ready to go to work on it as soon as the Government accepts his offer. He works mighty fast when he undertakes anything.

The CHAIRMAN. I know he does. When he has 4 per cent money he can do it well when he gets at it.

We will take a recess until 2.30.

(At 1 o'clock p. m. a recess was taken until 2.30 o'clock p. m.)

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AFTER RECESS.

The committee reconvened at 2.30 o'clock p. m.
The CHAIRMAN. You may proceed, Mr. Silver.

FURTHER STATEMENT OF MR. GRAY SILVER.

Mr. SILVER. I do not know just where we left off, Mr. Chairman, but I think on my memorandum here we had gotten down to the question of the opposition.

The opposition to this matter of developing Muscle Shoals: The National Fertilizer Association, the by-product coke oven interests, the American Cyanamid Co., and others have vigorously opposed this development and have issued propaganda far and wide, in and out of Congress, and they must feel that there is some force and effect in the belief that a great many have that it would result in cheaper methods or cheaper production, or they would not have that fear of that development. They would not be uneasy about an interference with their business as set up and conducted, which has made the farmer very unhappy and caused him to seek for some other method of securing these necessary plant-food ingredients, commonly called fertilizer.

I was going to offer for the record, Mr. Chairman, a list of the constituent members of the American Fertilizer Co., just to show the names of those who are vigorously opposing it, if we have that with us.

Mr. BOWER. We have not that here.

The CHAIRMAN. All right.

LIST OF MEMBERS OF NATIONAL FERTILIZER ASSOCIATION.

HONORARY MEMBERS.

George Braden, Louisville, Ky.
Gustav Jarecki, Cincinnati, Ohio.
William Prescott, Cleveland, Ohio.
J. Rice Smith, Augusta, Ga.
William T. Wuichet, Dayton, Ohio.

ACTIVE MEMBERS.

Acme Manufacturing Co., Wilmington, N. C.
Adair & McCarty Bros. (Inc.), A. D., Atlanta, Ga.
Alabama Chemical Co., Montgomery, Ala.
Alliance Fertilizer Co., Alliance, Ohio.
American Agricultural Chemical Co., New York City.
American Cotton Oil Co., The, New York City.
American Fertilizer Co., Savannah, Ga.
Anaconda Copper Mining Co., Chicago, Ill.
Anderson Phosphate & Oil Co., Anderson, S. C.
Apothecaries Hall Co., Waterbury, Conn.
Arkansas Fertilizer Co., Little Rock, Ark.
Armour Fertilizer Works, Chicago, Ill.
Baltimore Pulverizing Co., Baltimore, Md.
Batesburg Cotton Oil Co., Batesburg, S. C.
Baugh & Sons Co., Philadelphia, Pa.
Berkshire Fertilizer Co., Bridgeport, Conn.
Blackshear Manufacturing Co., Blackshear, Ga.
Blackstone Guano Co., Blackstone, Va.
California Fertilizer Works, San Francisco, Calif.
Calumet Fertilizer Co., New Albany, Ind.
Camp, William H. (Inc.), Petersburg, Va.
Canton Fertilizer Co., Canton, Ohio.
Capital Fertilizer Co., Montgomery, Ala.
Caraleigh Phosphate & Fertilizer Works, Raleigh, N. C.
Central Chemical Co., The, Hagerstown, Md.
Chamberlain & Barclay, Cranbury, N. J.
Chicago Feed & Fertilizer Co., Chicago, Ill.
Contentnea Guano Co., Wilson, N. C.
Cope & Daffin (Inc.), Savannah, Ga.
Cotton States Fertilizer Co., Macon, Ga.
Darling & Co., Union Stock Yards, Chicago.

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Dainippon Jinzo Hiryo Kaisha (Ltd.), Tokyo, Japan.
Davison Chemical Co., Baltimore, Md.
Diamond Fertilizer Co., The, Sandusky, Ohio.
Dixie Guano Co. (Inc.), Suffolk, Va.
Drovers' Packing Co., Kansas City, Kans.
Empire Cotton Oil Co., Atlanta, Ga.
Empire State Chemical Co., Athens, Ga.
Etiwan Fertilizer Co., Charleston, S. C.
Exchange Supply Co., Tampa, Fla.
Farmers' Fertilizer Co., The, Columbus, Ohio.
Farmers & Planters' Co., The, Salisbury, Md.
Federal Chemical Co., Louisville, Ky.
Georgia Fertilizer & Oil Co., Valdosta, Ga.
Graselli Chemical Co., Cleveland, Ohio.
Griffith & Boyd Co., Baltimore, Md.
Groves Fertilizer Works, Cincinnati, Ohio.
Gulf Fertilizer Co., Tampa, Fla.
Gulfport Fertilizer Co., Gulfport, Miss.
Gunns (Ltd.), Toronto, Ontario, Canada.
Hafleigh & Co., Philadelphia, Pa.
Hamm Co., The M., Washington Courthouse, Ohio.
Hawaiian Fertilizer Co. (Ltd.), Honolulu, Hawaii.
Higgins, A. W., Westfield, Mass.
Home Fertilizer & Chemical Co., Baltimore, Md.
Home Guano Co., Dothan, Ala.
Hopkins Fertilizer Co., New Albany, Ind.
Hubbard Fertilizer Co., Baltimore, Md.
Huston, Darbee & Co., Seaford, Del.
International Agricultural Corporation, New York City.
Jackson Fertilizer Co., Jackson, Miss.
Jarecki Chemical Co., Cincinnati, Ohio.
Lebanon Fertilizer Works, Lebanon, Pa.
Lowell Fertilizer Co., Boston, Mass.
Macmurphy Co., Charleston, S. C.
Manning Oil Mill, Manning, S. C.
Mapes Formula & Peruvian Guano Co., New York City.
Martin Fertilizer Co., Philadelphia, Pa.
McCabe Fertilizer Co., Charleston, S. C.
Meadows, E. H. & J. A., New Bern, N. C.
Meridian Fertilizer Co., Meridian, Miss.
Miller Fertilizer Co., Baltimore, Md.
Morris Fertilizer Co., Atlanta, Ga.
Mutual Fertilizer Co., Savannah, Ga.
New Bern Cotton Oil & Fertilizer Mills, New Bern, N. C.
Nitrate Agencies Co., New York City.
Ober & Sons Co., G., Baltimore, Md.
Olds & Whipple, Hartford, Conn.
Ontario Fertilizer (Ltd.), Toronto, Ontario, Canada.
Pacific Guano & Fertilizer Co., Honolulu, Hawaii.
Painter Fertilizer Co., E. O., Jacksonville, Fla.
Pamlico Chemical Co., Washington, N. C.
Pelham Oil & Fertilizer Co., Pelham, Ga.
Phosphate Mining Co., Savannah, Ga., and New York City.
Piedmont-Mount Airy Guano Co., Baltimore, Md.
Pierce, William M., Milford, Del.
Pittsburgh Provision & Packing Co., Pittsburgh, Pa.
Planters Fertilizer & Phosphate Co., Charleston, S. C.
Pocahontas Guano Co., Lynchburg, Va.
Porter Fertilizer Co., Atlanta, Ga.
Price Chemical Co., Louisville, Ky.
Priddy & Co., Charles W. (Inc.), Norfolk, Va.
Ramsburg Fertilizer Co., Frederick, Md.
Raisin-Monumental Co., Baltimore, Md.
Rauh & Sons Fertilizer Co., E., Indianapolis, Ind.
Read Phosphate Co., Nashville, Tenn.
Reading Bone Fertilizer Co., Reading, Pa.
Reliance Fertilizer Co., Savannah, Ga.

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Richmond Guano Co., Richmond, Va.
Robertson Fertilizer Co., Norfolk, Va.
Rogers & Hubbard Co., Middletown, Conn.
Royster Guano Co., F. S., Norfolk, Va.
Scholze, H. A., Chattanooga, Tenn.
Scott Fertilizer Co., Elkton, Md.
Smith Agricultural Chemical Co., Columbus, Ohio.
Southern Agricultural Chemical Corporation, Atlanta, Ga.
Southern Fertilizer & Chemical Co., Savannah, Ga.
S. States Phosphate & Fertilizer Co., Augusta, Ga.
Stadler, J. L. and H., Cleveland, Ohio.
Standard Chemical & Oil Co., Troy, Ala.
Stone Sons, William (Ltd.), Woodstock, Ontario, Canada.
Swift & Co., Union Stock Yards, Chicago, Ill.
Tennessee Chemical Co., Nashville, Tenn.
Thomas & Son Co., I. P., Philadelphia, Pa.
Tilghman Co., William B., Salisbury, Md.
Tomlinson Guano Co., Wilson, N. C.
Tunnell & Co., F. W., Philadelphia, Pa.
Tupelo Fertilizer Factory, Tupelo, Miss.
United Chemical & Organic Products Co., Chicago, Ill.
Virginia-Carolina Chemical Co., Richmond, Va.
Welch Chemical Co., Columbus, Ohio.
West Coast Fertilizer Co., Tampa, Fla.
Whitman & Pratt Rendering Co., Boston, Mass.
Wilcox Fertilizer Co., Mystic, Conn.
Wilcox, Ives & Co., Savannah, Ga.
Wilson & Co., Chicago, Ill.
Wilson & Toomer Fertilizer Co., Jacksonville, Fla.
Woodruff Oil & Fertilizer Co., Woodruff, S. C.
Wuichet Fertilizer Co., Dayton, Ohio.
Wulbern Fertilizer Co., Charleston, S. C.
York Chemical Works, York, Pa.

ASSOCIATE MEMBERS.

American Trona Corporation, New York City.
American Cyanamid Co., New York City.
American Limestone Co., Knoxville, Tenn.
American Potash Co., Lincoln, Nebr.
Anthony, Carl H., Baltimore, Md.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Atlanta Utility Works, East Point, Ga.
Austin Co., Cleveland, Ohio.
Automatic Weighing Machine Co., Newark, N. J.
Baker & Bro., H. J., New York City.
Barrett Co., New York City.
Bixby & Marshall, Baltimore, Md.
Brode & Co., F. W., Memphis, Tenn.
Brown, W. W., Atlanta, Ga.
Buckeye Cotton Oil Co., Cincinnati, Ohio.
Charleston Lead Works, Charleston, S. C.
Consolvo & Lyle, Norfolk, Va.
Coronet Phosphate Co., New York City.
Cottman & Co., J. H., Baltimore, Md.
Crafts & Co. (Inc.), James G., Savannah, Ga.
Cudahy Packing Co., Chicago, Ill.
Fairbanks Co., Baltimore, Md.
Floyd, P. C., St. Louis, Mo.
Foster & Co., Chas. T., Baltimore, Md.
Freeport Sulphur Co., New York City.
Fridley Commission Co. (Inc.), Chicago, Ill.
Fuller-Lehigh Co., Fullerton, Pa.
Garrigues Co., Chas. F., New York City.
Gascoyne & Co., Baltimore, Md.
General Chemical Co., Chicago, Ill.
Gibbs & Co., Antony, New York City.

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Gilchrist, Peter S., Charlotte, N. C.
Goldsmith, Simon M., New York City.
Grace & Co., W. R., New York City.
Graffin Co., J. C., Baltimore, Md.
Guarantee Construction Co., New York City.
Hardinge Co., New York City.
Hayward Co., New York City.
Hollingshurst & Co. (Inc.), New York City.
Hoover & Mason Phosphate Co., Mount Pleasant, Tenn.
Howe Chain Co., Muskegon, Mich.
Jeffret Manufacturing Co., Columbus, Ohio.
Johns-Manville Co., H. W., New York City.
Kent Mill Co., Brooklyn, N. Y.
King, M. C., Atlanta, Ga.
Knight, Maurice A., East Akron, Ohio.
Lang & Co., J. M., Savannah, Ga.
Law & Co., Atlanta, Ga.
Link-Belt Co., Philadelphia, Pa.
Manito Chemical Co., Peoria, Ill.
Marden, Orth & Hastings Corporation, New York City.
McCandless Laboratory, Atlanta, Ga.
McIver & Son, Alexander M., Charleston, S. C.
McKoin & Co., Atlanta, Ga.
Meeker, Edward P., New York City.
Mente & Co. (Inc.), New Orleans, La.
Mitsui & Co., New York City.
Molony & Carter Co., Charleston, S. C.
Morgan Bros., Richmond, Va.
Myers, William S., 17 Madison Avenue, New York City.
National Lead Co., New York City.
Naylor & Co., New York City.
Neville, McIver, Barnes & Co., Savannah, Ga.
Northern, W. C., Memphis, Tenn.
Norfolk Tallow Co., Norfolk, Va.
Pacific Manure & Fertilizer Co., San Francisco, Calif.
Palmer-Murphy Co., Atlanta, Ga.
Parker Laboratory, Charleston, S. C.
Parsons & Pettit, New York City.
Peeples & Fields, Atlanta, Ga.
Peters Co. (Inc.), C. B., New York City.
Peters, White & Co., New York City.
Philadelphia Bag Co., Philadelphia, Pa.
Potash Reduction Co., Omaha, Nebr.
Pratt Engineering & Machine Co., Atlanta, Ga.
Pringle, A. F. (Inc.), Charleston, S. C.
Pyrite Co. (Ltd.), New York City.
Raymond Bros., Impact Pulverizer Co., Chicago, Ill.
Rice, Charles W., Columbia, S. C.
Riegel Sack Co., New York City.
Rielly-Edwards Co., Baltimore, Md.
Robertson & Cohen, Charleston, S. C.
Robertson Lead Co., James, Baltimore, Md.
Robinson & Co. (Inc.), Dwight P., New York City.
Sacket, A. J., Baltimore, Md.
Schmaltz, Joseph H., Chicago, Ill.
Shuey & Co. (Inc.), Savannah, Ga.
Smith & Kelly Co., Savannah, Ga.
Snelling, William M., Norfolk, Va.
Societe Commerchaile des Potasses d'Alsace, 25 West Forty-third Street, New York City.
Southern Phosphate Corporation, New York City.
Southern Supply Co., Norfolk, Va.
Standard Potash Co., Omaha, Nebr.
Starnes Co., Birmingham, Ala.
Stedman's Foundry & Machine Works, Aurora, Ind.
Stiles & Seaman (Inc.), Savannah, Ga.
Struven & Co., Charles M., Baltimore, Md.

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Sturtevant Mill Co., Boston, Mass.
Stuter & Co., Eugene, New York City.
Taylor Commission Co., G. F., New York City.
Texas Gulf Sulphur Co., New York City.
Thew Automatic Shovel Co., Lorain, Ohio.
Tyler Co., W. S., Cleveland, Ohio.
Union Sulphur Co., New York City.
United Fertilizer Co., Milwaukee, Wis.
United States Industrial Chemical Co., Curtis Bay, Md.
Utah-Salduro Co., Salt Lake City, Utah.
Walker & Elliott, Wilmington, Del.
Walter Co., Edw. J., Baltimore, Md.
Ware Bros. Co., Philadelphia, Pa.
Wedge Mechanical Furnace Co., Philadelphia, Pa.
Werthan Bag Co., New York City.
Wessel, Duval & Co., New York City.
White & Co., Thomas H., Baltimore, Md.
Wiley & Co., Baltimore, Md.
Wisner & Stetson, New York City.
Wood, Henry H., New York City.
Young Commission Co., Memphis, Tenn.

Mr. SILVER. One of the interests that I did not mention is the water power interests, who had Mr. Cooper to testify on the other side. I have a list of the groups which they represent, and if there is no objection, I would like to have that go in, and I will offer the other at another time.

The CHAIRMAN. All right.

(The list submitted by Mr. Silver is as follows:)

Mr. Cooper is vice president and a director of the Mississippi Power Co. which sells power to St. Louis, East St. Louis, Hannibal, Alton, Quincy, Burlington, Fort Madison, Keokuk, and adjacent territory. It is one of the largest hydroelectric plants in the world.

Stone & Webster Co. (Inc.) is the general manager of this company.

The following companies are managed and operated under this same management:
Baton Rouge Electric Co.
Blackstone Valley Gas & Electric Co.
Cape Breton Electric Co. (Ltd.).
Central Mississippi Valley electric properties.
Columbus Electric Co.
Columbus Power Co.
Columbus Railroad Co.
Connecticut Power Co.
Dallas City Illinois Light Co.
Eastern Texas Electric Co.
Edison Light & Power Co., Abington and Rockland.
Edison Electric Illuminating Co., Brockton.
El Paso Electric Co.
Fall River Gas Works Co.
Fort Madison, Iowa, Electric Co.
Galveston Electric Co.
Galveston, Haston Electric Co.
Galveston, Haston Electric Railway Co.
Haverhill Gas Light Co.
Houghton Company Electric Light Co.
Houghton Electric Traction Co.
Key West Electric Co.
Lowell Electric Light Corporation.
Millerton Electric Light Co.
Mississippi River Power Co.
North Texas Electric Co.
North Texas Traction Co.
Nova Scotia Tramway & Power Co. (Ltd.).
Pacific Northwest Traction Co.
Paducah Electric Co.
Pawtucket Gas Co., New Jersey.
Ponce Electric Co.
Public Service Investment Co.
Puget Sound Electric Railway.

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Puget Sound Interurban Railway & Power Co.
Puget Sound Power & Light Co.
Reno Power, Light & Water Co.
Savannah Electric Co.
Savannah Power Co.
Sierra Pacific Electric Co.
Sydney and Glace Bay Railway Co. (Ltd.).
Tacoma Railway & Power Co.
Tampa Electric Co.
Tarrant County Traction Co.
Trucker River General Electric Co.

Mr. SILVER. To get back to the board's proposal specifically and to discuss some features of the proposal itself, he agrees to form a company with $10,000,000 capital stock, and he has that much at stake, at least, that he will keep faith with the contract made with the Government. They have the right in the contract to cancel on him if should not do that.

He agrees, further, that he will complete Dam No. 2 at cost and without profit to himself. That, of course, is important, for when he agrees to do that he keeps in mind that he must do it economically and right, for he agrees to reimburse that amount and pay interest on it while he does it, which is exactly the reverse of the cost-plus contracts during war times, which caused a great deal of unhappiness to taxpayers.

He will lease Dam No. 2 for a hundred years and pay 4 per cent interest upon the cost at completion. That is another way of stating about what I did state.

Ford will pay annually $35,000 per year for repairs, maintenance, and operation of Dam No. 3, its gates and locks, the company to maintain power house and machinery.

He will furnish free 200 horsepower to operate locks.

He will construct Dam No. 3 at cost without profit.

He will lease Dam No. 3 for 100 years and pay 4 per cent interest on its cost, including lands and flowage rights.

He will pay annually $20,000 for repairs, maintenance, and operation of Dam No. 3, its gates and locks, the company to maintain power house and machinery.

He will furnish free 100 horsepower for the operation of the locks.

He will establish a sinking fund by the semiannual payment of $23,373.

Both dams are to be built at cost, without profit, in accordance with the specifications of the United States engineers. Looking ahead to lease provisions, where the company agrees to lease the finished work for 100 years and to pay 4 per cent interest on the cost of construction, we find a construction arrangement that guarantees both quality and economy of construction. The company constructing is to use the property for a hundred years, and is therefore vitally interested in the quality of the work. The company also agrees to pay 4 per cent interest on the cost, and the resulting condition is exactly opposite to the much-criticized cost-plus method of construction.

As to the financing of construction, no appropriation is required from the Treasury to complete Dam No. 2 or to build Dam No. 3. The proposal agrees to pay 4 per cent interest on the cost of constructing both dams, and, further, provides a sinking fund which at the end of the lease period will retire $48,000, which is more than will be required to finish Dam No. 2 and to build Dam No. 3.

The CHAIRMAN. Where will he get the money to build Dam No. 2, for instance, if no appropriation is necessary.

Mr. SILVER. From the authorization of bonds.

The CHAIRMAN. Oh.

Mr. SILVER. Authorize the sale of bonds.

The CHAIRMAN. Oh, yes; his proposition is to get that money by the sale of bonds.

Mr. SILVER. Yes.

The CHAIRMAN. That is not Ford's offer. Of course, it does not make any difference to Ford how we get the money.

Mr. SILVER. No; he does not provide for the method of getting the money in the contract, but all he proposes is to amortize and issue the amount of bonds necessary, estimated as $40,000,000, to retire them, and he would pay back with interest on $53,000,000 all told.

The CHAIRMAN. Have you ever computed what this interest would actually do for what the Government is out on these dams. Of course, it would be a great deal less than 4 per cent that we are really giving the money to Mr. Ford at. Did you know that?

Mr. SILVER. I do not know that I catch what you mean.

The CHAIRMAN. Well, we have already spent $17,000,000.

Mr. SILVER. Yes; I understand that.

The CHAIRMAN. We do not get anything from that.

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Mr. SILVER. No.

The CHAIRMAN. We donate that.

Mr. SILVER. That is one of the war wastes.

The CHAIRMAN. And Mr. Ford does not commence to pay interest until after the dam is completed.

Mr. SILVER. Well, he can not well use it until after the dam is completed.

The CHAIRMAN. I am not criticizing that.

Mr. SILVER. No.

The CHAIRMAN. You are jumping at conclusions. Now, we will have to supply the money?

Mr. SILVER. Yes.

The CHAIRMAN. Assuming that it takes two or three years to finish that dam——

Mr. SILVER. Yes.

The CHAIRMAN. We will be out of the use of most of it for that time, without any interest.

Mr. SILVER. I do not know what length of time it will take. Mr. Ford, in talking with the Secretary of War, thought it might be done in a year's time. Some of the engineers who passed on it said that 18 months would be a sufficient amount of time.

The CHAIRMAN. Well, the Government engineers say three years, and Mr. Ford's engineer said two years, or perhaps a year and a half, as I remember it. The very lowest was a year and a half.

Mr. SILVER. Yes; I think that was the lowest that the engineer said.

The CHAIRMAN. Yes. Now, you were not through with that statement?

Mr. SILVER. I will just finish it.

The CHAIRMAN. Yes.

Mr. SILVER. At the end of the lease period, he will retire $48,000,000, which is more than will be required to finish Dam No. 2 and to build Dam No. 3. In other words, he pays back more than the entire amount.

The CHAIRMAN. No; now, do not let us get that wrong. He does not pay back nearly as much as it cost.

Mr. SILVER. You did not let me finish. He pays back more than this additional investment that is asked for.

The CHAIRMAN. Yes.

Mr. SILVER. He does not pay back the investment that is made down there now.

With these provisions, a bond issue floated at 4 per cent to finance the necessary expenditure, without any appropriation, and the interest on and retirement of the bonds are to be paid by the company.

We submitted to the Secretary of War a letter on that question. That raised the question with the Secretary of War, and I would like to read that at this time, if I may, Mr. Chairman.

The CHAIRMAN. All right.

Mr. SILVER. It is dated January 9, 1922:

Hon. JOHN W. WEEKS,
Secretary of War, Washington, D. C.

MY DEAR MR. SECRETARY: In turning over in my mind our conference on Mr. Ford's proposal to take over the Muscle Shoals development, and considering the various phases of the situation, I realize that the most serious difficulty appears to be the question of securing an appropriation at this time of heavy expenditure.

In searching for a solution it has occurred to me that an authorization for a Muscle Shoals bond issue of $40,000,000 would remove the necessity for an appropriation. I am confident that under present conditions such a bond issue could be floated at 4 per cent. The interest payments of Mr. Ford amounting to $1,680,000 annually would pay 4 per cent interest of $42,000,000 of bonds. He provides an amortization fund through which the bonds would be retired at the end of the 100-year period. It would be my thought to issue the bonds for 50 years, at which time the sinking fund would have accumulated to the point where a reissue might be floated at a lower rate of interest. By this means the Government would secure the development of this power with no additional appropriation and have amortized nearly one-half of the present war-time expenditure of $17,000,000 on the dam, since the amortization fund will in addition to retiring the bond issue of $40,000,000 retire $8,000,000 additional.

Should this suggestion meet with your approval we shall be glad to cooperate with you in securing the adoption of this plan of financing the development.

Very truly, yours,

AMERICAN FARM BUREAU FEDERATION.
GRAY SILVER, *Washington Representative.*

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The CHAIRMAN. You might be able to do it in a year or so if things keep on improving, but I do not believe we could sell bonds now at par at 4 per cent.

Mr. SILVER. I would think so, Mr. Chairman.

The CHAIRMAN. Would you?

Mr. SILVER. Yes, sir; I do think so.

The CHAIRMAN. Four and one-quarter per cent bonds, with some tax exemption features, can be bought for less than par on the market right now.

Senator HEFLIN. These are the farm-loan bonds.

Mr. SILVER. Four and one-half per cent.

The CHAIRMAN. Yes; but the thing that makes the farm-loan bond sell is the fact that it is exempt from all Federal and State taxation, while United States bonds are only partially exempt.

Mr. SILVER. Some issues of them; yes.

The CHAIRMAN. Practically all of the Liberty bonds.

Mr. SILVER. Yes.

The CHAIRMAN. They pay 4¼ and are selling now below par. How could you expect a 4 per cent bond to sell for par now unless it is completely exempt from taxation, income, and Federal and State taxes of all kinds? That is not of very great importance, but I think we ought to face it as it is.

Mr. SILVER. I think so, too.

The CHAIRMAN. And I do not see how you could sell a 4 per cent bond at par.

Mr. SILVER. You may be right, Mr. Chairman, but I am of the opinion that, if necessary, the farmers of the country would buy them to see this project completed and put on an earning basis—that is, to reduce costs to them, that they might supply their needs on a less cost basis.

The CHAIRMAN. Well, I would not want to fool the farmers that way. I have always been square with the farmers, and I am not going to go into any deal to try to deceive them. I will not say to the farmer, "You buy these bonds and pay more than they are worth on the market, pay par for them, on the theory that five or six years from now, when Ford gets started, he is going to show you farmers something," when I have no way to guarantee that he will do it. In my heart I do not believe he will do it. He will probably die in a very few years, and his corporation will be just as heartless as any other corporation.

Mr. SILVER. I would not impose upon the farmer, if I could, but I do believe that the development there will result in a less cost factor to them, and besides 4 per cent is above the average for Government money.

The CHAIRMAN. The man who does it will be able to make a profit out of it I know, and that is the reason I want to save it for all of the people instead of giving it to one man, even though he is a good man, and there are other men in the country just as good as Ford. I think he is a good man, but I know some others I think just as much of and I would not want to let the Government furnish them with $40,000,000 or $50,000,000 on a hundred-year time basis at 4 per cent in order to enable them to do something cheaper, either.

Mr. SILVER. In all of my testimony you will notice, Mr. Chairman, that it has been the accomplishment of a purpose rather than Mr. Ford individually. Whilst I have the greatest confidence in Mr. Ford, and I do not think he is the only good man in the country, but he is the only good man who has bid for this property, and consequently he is in a class to himself so far as that is concerned. I might pick out other people that are splendid, high-class men, but if they are not bidders they do not come into consideration here.

The CHAIRMAN. Sure, if I were to give this snap to anybody I would rather give it to Ford than a good many other people I know, but I do not want to give it away because it is Ford.

Mr. SILVER. I am not looking at it from the viewpoint that you do, because you take a natural resource and make it work for the people to whom it belongs. That is not giving it away. It is simply the Government, the people's representatives, putting it to work for them.

The CHAIRMAN That is where you are mistaken. There is where your statement is entirely wrong. You have not anything to base it on. There is nothing in the record that will sustain you. You are not developing this for all the people. You propose, yourself, to give it to Mr. Ford's corporation, which is going to run it for a hundred years, and you assume, to begin with, that the people are going to get the benefit of it, when there is not anything in the contract to that effect. Mr. Ford does not agree to it even while he lives. You are assuming all of those things and there is nothing to it.

Senator HEFLIN. But it will be drawn up in the contract; those things, so far as fertilizer is concerned, will be put into it.

The CHAIRMAN. Then draw the contract accordingly.

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Senator HEFLIN. But he proposes to manufacture fertilizer, and get it at half cost, because he has not guaranteed that he will not. There is no question about that, and nobody expects him to make that kind of a contract, and Mr. Ford will tell you to-day that he will not do it. If you put the contract under his nose he will refuse to sign it.

Mr. SILVER. I would like to have something further to say on that, but I would like to go ahead with my statement now just to keep it in sequence.

The CHAIRMAN. All right.

Mr. SILVER. As to the lease of the dams, the lease for 100 years is justified from the standpoint that at the end of the lease period the development is returned to the Government with all capital charges against the water power wiped out, and from then on the power is free from interest charges.

The CHAIRMAN. Now, just a minute on that. You say at the end of a hundred years there is going to be returned to the Government, but all of the other property is given to Ford free from every obligation, or to this corporation for a hundred years. At the beginning of this thing the Government has the dams and the Government has all of the other property. At the end of the hundred years the Government is going to have the dams free, but this corporation is going to own the balance of the property.

Mr. SILVER. That is property that they have either bought or constructed there.

The CHAIRMAN. It is what they bought.

Mr. SILVER. But if they develop this property they will have a great investment there, of course. That will be their private interest and private development.

The CHAIRMAN. What they may develop there will be theirs, that is all right, but at the end of a hundred years the Government won't even own this nitrate plant; it will not have any contract with Mr. Ford that he will operate the nitrate plant. If, in 101 years we would have another war, we would be without any nitrate plant, and Mr. Ford would not be under any obligation to operate a nitrate plant.

Mr. SILVER. At end of period the Government will own two dams completed which it has not got to-day and will not have paid for them. Full nitrate equipment will be there probably much improved; will have saved maintenance and depreciation cost over the entire period.

Senator HEFLIN. You could commandeer it.

The CHAIRMAN. Sure we could, but we would have to pay for it if we did, and we have it now.

Mr. SILVER. Do you think for a minute, Mr. Chairman, that if Mr. Ford did not come along, and if you let that plant stand free from cost, that you would have a plant?

The CHAIRMAN. Yes; if we passed the bill that I have introduced, at the end of 100 years the difference will be that we will have the plant and water both and own it all, just as we do now, and it will all be paid for long before the hundred years is up.

Mr. SILVER. But the cost of keeping that plant in standby condition is considerable.

The CHAIRMAN. No; but we would use it. If Ford can use it we can use it.

Senator HEFLIN. But Ford will have paid to the Government at the end of 100 years more than the Government will have spent originally.

The CHAIRMAN. No; not by a good ways. He gets what the Government has spent. The Government has spent, in round figures, $100,000,000 now. He just gives us $5,000,000 for that, and at the end of that time we are to get back from Ford the dams, not what they cost, but what it takes from now on to complete them. That is what Ford pays back.

Senator HEFLIN. Does it not pay it back with interest, and will not all of the payments that he makes at the end of 100 years amount to as much as the Government has invested?

The CHAIRMAN. No; I do not think so, but that would not be any criterion, anyway.

Mr. SILVER. He pays back $53,000,000 plus the interest, which would exceed it, but I was not adding that interest as we went along.

The CHAIRMAN. Of course, he pays 4 per cent interest. If we should put the proposition up to Morgan to-morrow to build any kind of a plant in Chicago or Omaha or out in the country some where, a big manufacturing plant, and tell him that we would furnish the money to him for 100 years at 4 per cent interest, and let him pay it annually and amortize it over 100 years, he would jump at the chance. There are thousands of men in the United States that would go into all kinds of things. You say he will be able to make those things cheaper. There is not any doubt about it, but if we had a guaranty that he would sell them cheaper to the consumer than we are paying now, you would have a different proposition, but that is not in the offer of Mr. Ford's corporation.

Senator HEFLIN. And nobody else has offered it.

The CHAIRMAN. Of course, they have not offered it. I am not claiming that they have. The Government owns this property and built it as a war-time proposition.

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and I want them to keep it. I would not want them to give it to anybody, even though he were better than Ford; even though he were a preacher, I would not want to give it to him.

Mr. SILVER. Let us go down through this list and we will discuss that a little further. I will go on from where I left off above.

When it is realized that interest on capital invested is 80 per cent on the cost of electric power from a hydroelectric development, this method of amortizing the investment and relieving the power of interest charges is most valuable to the people. This interest cost is also the reason that the Government should loan its borrowing capacity to finance the building of the dams. Since interest charges are so important a factor in the cost of power, the lowest interest rates obtainable should be utilized in developing our great water power resources. Since these water powers are looked at as belonging to the people, the collective borrowing capacity of the people, through their Government, should be utilized to finance the development of these water-power resources. This is especially true since it puts no expense on the Government nor on the people and so greatly reduced the cost power developed.

As to navigation, the company pays the expense of operating the locks and furnishes free power for this purpose. The amounts of money and power furnished have been approved by the United States engineers as ample for this purpose. In addition to securing the navigation development free of cost, the Government also obtains the operation of the locks without expense.

No navigation at all is provided unless both Dam No. 2 and Dam No. 3 are built.

In addition to the navigation feature, Dam No. 3 can undoubtedly be built more cheaply by constructing it as workmen and equipment are released from Dam No. 2 than it could be built separately at a later date. As to the tying in or power, to obtain the fullest possible development of the potential power at Muscle Shoals, Dams No. 2 and No. 3 should be jointly operated and coordinated so as to supplement each other. Unless both dams were so operated no one would be justified in making the additional investment in storage reservoirs in the upper river to equalize the flow of the river, as is indicated in the hearings, is the purpose of Mr. Ford.

Now, going again to paragraph 11: Purchase (*a*) nitrate plant No. 2, (*b*) nitrate plant No. 1, (*c*) Waco quarry, (*d*) the ownership of the Government in the Gorgas steam plant. That is what he proposes to purchase for the amount of money that he states in his tender.

The CHAIRMAN. $5,000,000?

Mr. SILVER. Yes.

The CHAIRMAN. Do you know anything about how the Government's interest is tied up in the Gorgas plant? Have you studied the Government's contract with the Alabama Power Co. when that was built?

Mr. SILVER. I have not, Senator, although I have heard a great deal of discussion about it, but personally I have not studied that feature, as Mr. Ford is willing to take the place of the Government it is not important.

The CHAIRMAN. All right. We can not expect you to discuss it if you have not studied it.

Mr. SILVER. As to the purchase of nitrate plants and so forth, the purchase price of $5,000,000 has been criticized as too low, but when it is realized that the proposal provides for the operation and maintenance of the nitrate plant at its present capacity, this sale must be looked at from a different light.

The CHAIRMAN. Well, the operation of the nitrate plant comes not as a part of the consideration of the sale of the property, as I understand it?

Mr. SILVER. Oh, yes. He agrees on that as part of the tender to operate it and keep it a going concern, to keep it up and to pay for the use of it any time he may need it.

The CHAIRMAN. Well, he expects to make money on that proposition. He is not going to make 8 per cent interest, but that is the thing where Mr. Ford feels able to make this agreement to operate that plant. That is the power at the dams. There is no doubt about that. That is where the cream is in the contract.

Mr. SILVER. I do not know that I quite get that.

The CHAIRMAN. Mr. Ford has all the power that is developed at Dams Nos. 2 and 3?

Mr. SILVER. Yes.

The CHAIRMAN. And it is net to him, except what power it takes to operate the nitrate plant.

Mr. SILVER. The nitrate plant is what he has contrated to do in this particular clause.

The CHAIRMAN. That will take only about one-third of the water he develops, or not that much, I guess.

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Mr. SILVER. He pledges that he will develop that much. That does not mean that he won't use it.

The CHAIRMAN. It does not mean that he will have to use more, and of course will not, unless it should be profitable to manufacture more fertilizer.

Senator HEFLIN. I believe he will make it profitable.

The CHAIRMAN. Well, he probably will if he gets it, but it is a great thing that he will get. He will get pretty nearly $100,000,000 worth of property for $5,000,000, and that is not the big profit. The big profit in Ford's proposition is the power that he gets with which he can turn the whole earth around on its axis, pretty nearly, and it will not cost him anything. He gets it for nothing. He will pay it back, the principal and interest, at 4 per cent, but he will make it out of that power, and that is what he expects to do.

Mr. SILVER. Well, I should think he would make it, but he turns back to the Government a completed, paid-for, and developed property for the use and benefit of all the people. He pays back to the cost in full; he pays interest at 4 per cent for the entire period; he assumes the burden for the operation of the nitrate plant which perhaps may be larger than we appreciate; he agrees to maintain a research on commercial scale into the whole fertilizer field and employ new processes. This will take 100,000 horsepower as a minimum all the year round. There is only 140,000 primary all-the-year-round power at both dams. He will have to invest in storage reservoirs to make the power valuable at costs conservatively figured at $20,000,000. There are some of the things he pays money for. Then he maintains an adequate nitrogen protection for the Government free; he bears all maintenance and depreciation charges on the plant; he furnishes navigation scott free. So it is not such a one-sided problem when you analyze it closely.

The CHAIRMAN. Oh, yes.

Mr. SILVER. And the public has all the time enjoyed their equity in it.

The CHAIRMAN. Yes; he turns that back at the end of a hundred years in good condition, but that has all been built out of Government money; the taxpayers furnishing it all, and Mr. Ford has not put a single dollar in the development of the power, or not a penny. He will spend a whole lot of other money in building factories, but he will not turn them over to the Government. They will be his. He will build them and operate them with this power that he gets from the Government for nothing.

Senator HEFLIN. He will be doing a lot of good with them, Mr. Chairman.

The CHAIRMAN. I think he will. I have no doubt of that.

Mr. SILVER. Would you simply say that he did that all at Government expense, when he has returned the Government's money?

The CHAIRMAN. He is going to build these dams at Government expense. I do not mean any of his private property.

Mr. SILVER. But he returns it all.

The CHAIRMAN. Of course he does, but he makes it out of the very thing that he built with the Government's money. If does not cost him a penny.

Mr. SILVER. If he did not, he certainly would not agree to make the money elsewhere and retire the Government's investment which many people in and out of Congress advised junking a year since.

The CHAIRMAN. Mr. Silver, if we entered into a contract to-day with him, he could go on to Wall Street to-morrow and sell it for $50,000,000 cash. One witness has testified that and I think he is very low in his estimate. Of course, if that is the best thing we can do we ought to give it to him anyway.

Senator HEFLIN. Why is it that some of these interests do not come here and make a better offer for it than Mr. Ford, if that is the situation?

The CHAIRMAN. I would not accept it if they did, Senator. You can not scare me with that sort of a proposition. I would not sell it to anybody.

Senator HEFLIN. I am in doubt as to whether this $50,000,000 proposition is in existence; that is all I mean.

The CHAIRMAN. It probably is not in existence, but I can see it. It is perfectly plain. In the first place, if Ford should get this tomorrow, he could turn around to the Alabama Power Co. and, in my judgment, he would get $3,000,000 right off for the Gorgas plant. I do not know anything about it, except I know how it is located and what use they have for the power, and they can afford to pay that for it.

Senator HELFIN. There is no doubt that these coal mines around the Gorgas plant need the power they now get from the Gorgas plant.

The CHAIRMAN. Oh, yes; they could sell the power. There is no question about that.

Senator HEFLIN. But Mr. Ford will not deny them the use of that power. I am satisfied of that.

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The CHAIRMAN. I do not care whether he does or not. All I care for is the people of the United States, particularly the farmers, whom I think you fellows are all fooling. They are going to wake up to it some day.

Senator HEFLIN. We are trying to relieve them. I hope we are not fooling them.

Mr. SILVER. If there is a margin of $50,000,000 on that property just by the Government's act, why did not somebody bid when it lay idle down there and without friends. All of these special interests said it was worthless and was junk, and they did what they could to see that the Government did not develop it.

The CHAIRMAN. If J. P. Morgan came here with Mr. Ford's proposition, and Congress accepted it, you would be writing letters to all of the farmers all over the United States condemning this Congress, saying that they had sold the rights that belonged to the people and to their unborn children. You would be condemning them, and I think rightfully. That would be the cry that would go out, that Congress has sold out this great possibility down there that the people ought to retain to a corporation. That is just what you are asking us to do now because it happens to be popular. Ninety-nine per cent of the letters that I am getting from all over the country about this proposition say, "Give this to Ford." And when I ask some of them, "What do you know about Ford's offer?" they say, "I don't know anything about it; it is Ford; that is all I know." And that is what you are doing to-day, notwithstanding the fact that a year ago this same organization went on record to the effect that these things should be preserved for all time. Now, if I were suspicious—and I do not have any suspicion; I am not questioning your motives—but if I were half as suspicious as you are, I would be wondering in your own mind how it is that you flopped over from one proposition to another, and I would say, "Why, this great big corporation has bought all of these men; it has bought the organization, and they have it now. A year ago they did not have it. You stood for retaining this property in the Government of the United States for all the people, and now you have reversed your position and you want us to give it to a corporation." If I was at all suspicious, that is what I would think.

Senator HEFLIN. But the Government abandoned the other proposition there.

The CHAIRMAN. No; the government did not abandon the proposition. I beg your pardon.

Senator. HEFLIN. I mean they quit working there.

The CHAIRMAN. I went so far as to draw a bill, and I carried out that very same proposition with this same bunch of farmers. Now, I expect them to be condemning me as selling out, because I will not sell out to Ford's corporation, but I am advocating the very thing that they asked us to do then.

Mr. SILVER. Mr. Chairman, I tried this forenoon to make plain one feature, but it seems that I have not. This is the report of the committee. This report was made on—have you the date there?

The CHAIRMAN. May 31, 1921, that report was made.

Mr. SILVER. Now, I tried to make plain that that is the report of the committee appointed by the federation to make this investigation and report, and they did so, but at the next annual meeting following that, when this matter came up for ratification by the delegates at large, they passed the resolution which I read into the record here, approving Ford's tender.

The CHAIRMAN. Yes.

Mr. SILVER. I just wanted to get that straight in the record.

The CHAIRMAN. Well, I have all of that straight. That is nothing new. I knew that.

Mr. SILVER. But you just said now that the organization had flopped.

The CHAIRMAN. It has absolutely flopped.

Mr. SILVER. But there is a difference there and I wanted to emphasize that. I wanted to get it straight in the record, so that the reader will understand it. It is the difference between a committee report and the action of the convention.

The CHAIRMAN. Oh, yes, I will concede that there is a difference.

Mr. SILVER. I wanted to be sure of that.

The CHAIRMAN. Do you want us to believe, then, that this report of the Committee on Muscle Shoals, made a year ago by the committee that investigated it, which went on the ground and studied it, has been repudiated by the organization that sat up here in Chicago or somewhere and did not go on the ground and did not know anything about it except what they read in the newspapers or what somebody told them about it?

Mr. SILVER. The annual convention was held at Atlanta. A great many of them coming from the west and the southwest stopped at Muscle Shoals on their way to the convention, and it was a matter of debate on the floor and they arrived at their conclusions. Now, you and I might have the same facts and arrive at a different conclusion.

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THE CHAIRMAN. Oh, yes.

MR. SILVER. Those facts are not questioned. They had the utmost confidence in their committee, and they believed the facts to be the facts, and they went on the ground, and the resolution itself speaks of the conclusion which they arrived at.

THE CHAIRMAN. Yes.

MR. BOWER. Of course, Senator, there is one thought in there that you appreciate. This report was made, of course, before there was any Ford proposition.

THE CHAIRMAN. Yes; I understand that. I am not saying that you had not a right to do just what you have done, but what I am calling your attention to—and I am not questioning the sincerity of anybody in doing that——

MR. BOWER. Oh, we know that.

THE CHAIRMAN. But you have already offered in evidence things here to show that a whole lot of what you call special interests are opposed to this proposition. Now, if I were half as suspicious as you are I would wonder what happened to you. When you got down there under the influence of a local condition existing in Alabama where a man would not be safe if he would not put a badge on and say "I am for Ford," and where, if they caught him without a badge they would hang him up to the first tree—you were down in that locality——

SENATOR HEFLIN. I do not think it is quite that bad, Mr. Chairman.

THE CHAIRMAN. You would naturally be in favor of Ford. If I were inclined to be suspicious I would say, "Ford has bought you; you have sold out to Ford or to his corporation."

MR. BOWER. I think, instead of anything like that having happened—and, of course, you realize that that did not happen, what happened was that the Ford proposal was made afterwards. We had no Ford proposal when that resolution was adopted.

THE CHAIRMAN. I understand that.

MR. BOWER. Ford made a proposal, and the convention indorsed his proposal in preference to Government operation.

THE CHAIRMAN. Well, I do not believe the farmers of America prefer the Ford proposition in preference to this committee report that was the result of so careful an investigation. I do not believe it, notwithstanding the Atlanta Convention went on record to that effect, and I do not believe that the farmers or any other group of our citizens will uphold any action of Congress that will give away these valuable rights which you have so nicely described, belonging to all the people, to any dam corporation, I do not care whether it is Ford's or anybody else's, and it is not any better because it is Ford's, unless Ford is there to manage it, and then I concede it will be better; but you all know that Ford is going to die very soon, and then it will not be any better than Morgan's nor Rockefeller's, not a particle. It will be just the same, and you know, Mr. Silver, that if Rockefeller was making this proposition, or the International Harvester Co. was making this proposition that Ford makes, you would be here condemning it, and all of your fellows would be condemning it. There is not any doubt about that.

MR. SILVER. With knowledge of the fact that Mr. Rockefeller and the Standard Oil Co. have exploited these natural resources as they have, for private purposes, I think I would agree with that, because their record shows that they have an entirely different point of view from what Mr. Ford has in business.

THE CHAIRMAN. Sure, and your corporation will not be any better than Rockefeller's corporation.

MR. SILVER. I do not subscribe to that.

Senator HEFLIN. You can put it in the contract.

The CHAIRMAN. You can not put it in writing. I will defy anybody to try to draw a contract that will make it so after Ford's death. This corporation will be just the same as every other corporation. Anybody who gets control, who gets ownership of more than one half of the stock, will control it, and the stock will sell, in my judgment, immediately—if it should be organized to-morrow and Ford died the next day, and you were the owner of some of that stock as one of his descendants, you could get an advance of 1,000 per cent, right down on Wall Street, for this valuable contract.

Senator HEFLIN. But whoever gets it, Mr. Chairman——

The CHAIRMAN. I do not want anybody to get it.

Senator HEFLIN. But I say, whoever does get it, after he dies, the corporation is bound by the Government. They have agreed with the Government to manufacture fertilizers at 8 per cent.

The CHAIRMAN. But, Senator, you know there is not any such guaranty in that contract.

Senator HEFLIN. But you can put it in there.

The CHAIRMAN. You will not get Ford's signature if you do.

Senator HEFLIN. Well, he agrees that he will make it.

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The CHAIRMAN. Even if that were true, that only makes the contract all the more valuable. I do hope that they can make a profit on it, but if they do it only adds more to the value of the contract, because I am assuming that this nitrate plant No. 2 will be a load around his neck. I am inclined to think it will, from the evidence. If we have a new invention, as I think we will eventually, that load will be lessened, and it may turn it into a profitable thing, but every time it does it only adds to the value of his contract. The great big thing that he has in his contract is that he gets 500,000 or 600,000 horsepower for nothing. He constructs it out of Government money and then pays it back out of the profits from the very thing that the Government's money built. That is too much of a loss for the people of the United States to sustain. We ought to get the benefit of these great natural resources.

There is another thing you must not forget. One of the most dangerous things in government or business is a precedent. You are asking us to do something here that we never have done for anybody since we passed the general dam bill. By that Act we said we would not do it for anybody, that we would not jeopardize this valuable property anywhere, any of these resources, for longer than 50 years. Now, you would break that precedent for Ford. Next year, there will be some other man who will be shown to be of mighty good moral character, and we will do it for him. The result is that by the time we have reached a certain stage all of these valuable resources will be gone, and every man who has his hands in it will be condemned by honest citizens.

Mr. SILVER. I have more confidence in the people than you seem to indicate you have.

THE CHAIRMAN. But I think they are more intelligent than you seem to think.

Mr. SILVER. Columbus went out on a great uncharted sea when he started out to discover this country, and he felt sure that there would be on this land, if he found it, an administration of government. Washington went out on a great uncharted sea when we had trouble with England, feeling that if we kept this land we would have a proper government and an administration of government. Lincoln, when we had this feeling between the states, went out on an uncharted sea, and you, as a member of Congress, when we went to war with Germany recently, went out on an uncharted sea, feeling that no matter where we came out we would have government for the welfare of the people.

There is a change in the theory of the economic world, but we go on an uncharted sea to a certain extent, and when we do so we have belief and faith in the genius of our people and our institutions, and when you have once set up a development of the natural resources on a less cost basis, the people will certainly still function through their Government and have control of the things that are for the welfare of the people.

THE CHAIRMAN. Oh, yes, if you make a contract for your government to last for a hundred years, will the people be able to function through that government?

Mr. SILVER. Absolutely.

THE CHAIRMAN. Won't that be gone for a hundred years, or are you assuming that we are going to violate our contract with this corporation?

Mr. SILVER. The right to tax is the right to destroy.

THE CHAIRMAN. Oh, I see.

Mr. SILVER. When they see that this corporation or any other corporation is doing a bad thing the Congress of the United States will act. You acted recently in the Packers case, although it was enjoying no special privilege from the Government. You acted in the grain control case and many other cases. I just mention those ones because they are outstanding, and when the condition arises which you seem to think will arise in the future, if this tender is accepted, the government agencies will function. That is my belief.

The CHAIRMAN. Of course they will function.

I do not say that the Government is going to fail because we give Ford's corporation a great big cinch on things, but we are giving away something; there is no doubt about that, and you, Mr. Silver, certainly will not stand up here and say that if we do not like the way this thing works we are going to break our contract and violate our word. We must keep this contract for a hundred years if we make it.

Senator HEFLIN. But Ford's corporation must keep it, too.

The CHAIRMAN. Sure; they will not have very much to keep.

Mr. SILVER. And we will have governmental institutions to see that the faith is kept by all parties and for the benefit of all the people, I believe.

The CHAIRMAN. Exactly, but there is not any contract made with the corporation but what gives it the right to charge any price it pleases for anything that it makes there. You have no control over a single kilowatt of that power, and no corporation ever made a more unconscionable contract, as far as taking the rights of the people is concerned than you get here, where you have no control whatever over any price for anything that may be developed there. Now, if you want to retain the rights of the people, you

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ought to provide in your contract that somebody shall see that nobody shall profiteer on account of this great favor that the Government is extending, even though it is to Mr. Ford. If it was Jesus Christ I would want that in the contract, and I know He will live longer than Ford will. You cannot get away from that.

Mr. SILVER. There was no contract made with the railways when this Government and the State governments gave great land grants out West, more than there is in the great States of Indiana, Illinois, Ohio, and Pennsylvania, but we did afterwards set up a regulatory body in the Interstate Commerce Commission.

The CHAIRMAN. Oh, yes.

Mr. SILVER. And they do all the regulating they see fit.

The CHAIRMAN. But we did not do anything to violate our contract by which we had given the land, and you say now that we did right when we gave away all of that land to the Union Pacific Railway Co.?

Mr. SILVER. I was not justifying it, but I was illustrating the point, that in making the contract you are not giving away the governmental right of regulation.

The CHAIRMAN. Exactly, but you would not regulate this corporation any different from any other corporation. We gave to the Union Pacific millions of acres of land in my State, worth $250 an acre now. We gave it to that railroad for nothing. Millions of acres. When we came to regulate the Union Pacific Railway, the same regulation that road applies to the Burlington, to which road we gave nothing.

Now, you talk about the regulation of these corporations. If we ever do regulate corporations of this kind in any way we will treat this corporation the same as any other that has not been given special privileges. The parallel that you have given of our Government giving away lands to build the railroads is a good illustration. We are giving away here the rights of the people in the power that shall be developed in the Tennessee River, and we will be condemned just as much as those men are condemned now who gave away those public lands to these railroads.

Mr. SILVER. But we are in no way waiving our right to control nor are we giving away our property, for we sell or lease for the people's welfare.

The CHAIRMAN. Certainly, and we did not in that case.

Mr. SILVER. That is the point I wanted to make in that illustration.

The CHAIRMAN. Yes. Well, there is not anything in the point.

Senator HEFLIN. We will help the cause of navigation by building this project and letting Mr. Ford have it. With that power that we now can not use he will manufacture fertilizer there for a hundred years. He will increase the fertilizer supply and will free the farmers from the Fertilizer Trust, and all of that is very advantageous to us, Mr. Chairman.

The CHAIRMAN. If you give this to Mr. Ford, you won't have the water to control next week.

Mr. SILVER. The purpose for which the Government built this plant is fully protected by this provision of maintenance and operation of the nitrate plant. It is always available in efficient operating condition for the use of the Government in time of war. A low estimate of depreciation, maintenance, and guarding charges is $2,750,000 per annum. This annual saving is made for the Government by the acceptance of the offer.

A modification of the original proposal has removed the complications regarding the Gorgas steam plant, as Mr. Ford has agreed to accept what the Government can transfer under the contract with the Alabama Power Co.—

"15. Agrees to operate nitrate plant No. 2 at present capacity in the production of nitrogen and other fertilizers (capacity equal to 110,000 tons of ammonium nitrate per annum) through lease period. (*a*) Agrees to research fertilizer manufacture and employ such improved methods as may be found successful.

"(*b*) Agrees to maintain nitrate plant No. 2 or its equivalent for explosive manufacture in case of need.

"16. Limits profits on all fertilizer products to 8 per cent of fair actual annual cost of production. Agrees to a board of nine, of which seven are farmers nominated by American Farm Bureau Federation, National Grange, the Farmers' Union, and appointed by the President, confirmed by the Senate. Two members represent the company. An advisory member from the Bureau of Markets. Said board to determine cost and allowed to regulate price to limit profit to 8 per cent as above, shall have access to books and determine territorial distribution and regulate sale to farmers, their agencies or organizations."

The CHAIRMAN. Now, let us take that up for a while.

Mr. SILVER. All right.

The CHAIRMAN. I think the evidence as given by the scientific men discloses that the burden of this whole thing is the fertilizer proposition, and that is what you want.

Mr. SILVER. We are very much interested in that, yes; for the savings annually will buy the property.

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The CHAIRMAN. That is the difficult thing. We are all interested in it.
Mr. SILVER. Yes.
The CHAIRMAN. We want to get fertilizer.
Mr. SILVER. It is an essential thing to our civilization.
The CHAIRMAN. And if it is impossible, we can not get it. Now, I do not think that the thing you have just read there is of any importance, although you seem to think it is, and I may be wrong about it, that Ford shall not make more than 8 per cent on the fertilizer end of it, and to show that he will not make more than 8 per cent there is a board provided to look over the books and see that he sells it at a price which will not permit him to make more than 8 per cent.
Mr. SILVER. Yes, sir; that is right.
The CHAIRMAN. But the Government, in effect, furnishes him 4 per cent to operate it, and he agrees that he will not make more than 8 per cent out of this branch of it.
Mr. SILVER. I beg your pardon. It does not furnish him 4 per cent money to operate it.
The CHAIRMAN. I said "in effect."
Mr. SILVER. Four per cent money for the construction of the dam.
The CHAIRMAN. Yes; the dam, and the dam is one of the great factors in the operation of this plant. Now, supposing Ford made 25 per cent profit, and you make a great deal more than that on the water power feature of it, why don't you have a board appointed to see that he does not make more than 8 per cent there; that he sells the current to people so that he will not make any more than that? Why do you confine this board just to the fertilizer part of it?
Senator HEFLIN. We have a State law to cover that subject.
Mr. SILVER. Any time he sells power he comes under the State law. The State law of Alabama has that in charge.
The CHAIRMAN. Exactly. Then why don't you require him to sell it, in his bid, and you know he is not going to sell any, and he says he does not intend to sell it, and you do not expect him to sell any, do you, so that the Alabama law will not touch him?
Mr. SILVER. Whenever he sells it it will touch him.
The CHAIRMAN. He will not sell it.
Senator HEFLIN. Suppose he uses it for manufacturing purposes.
The CHAIRMAN. Exactly. That is what he is going to do. Suppose he makes 100 per cent on that part of it. Why are you so anxious in the proposition that he never will make 8 per cent, but when he comes to sell you a binder or a harrow or a plow or any other farm implement he may have a profit of 50 per cent and you do not care a damn about it; but if he is going to sell you a pound of fertilizer you do not want him to make more than 8 per cent.
Mr. SILVER. Nobody limits the price at which he sells his automobile, and all of the farmers are glad to avail themselves of that opportunity because it is the best buy they can make for the money.
The CHAIRMAN. Exactly.
Mr. SILVER. And we think that when he sells the farm implements he will manufacture them with the same degree of business acumen that he does his automobile.
The CHAIRMAN. All right. Then why do you insist on this 8 per cent theory if you have any such confidence in him?
Mr. SILVER. This is a special feature of the contract that we are very much interested in.
The CHAIRMAN. Of course you are very much interested in it, but why do you put it in?
Mr. SILVER. There is a difference in this special contract, because of that purchase right and the building existing there, and the shrinkage that has been made in the investment by the Government from the investment that you make under the contract with him, or under the state operation if he gets any business. If he sells that current he comes under the State law and if he don't he makes more supplies for the people at a cheaper price.
The CHAIRMAN. Now, you are avoiding it and you know you are avoiding it. You are not doing the square thing here. You know he does not intend to sell any. Now, if he makes a plow or makes a harrow and sells it and makes 50 per cent off of you, you do not care, but as to some fertilizer that you never expect him to make you do not want him to make more than 8 per cent on it. Why put in here that his company can not make more than 8 per cent on the fertilizer and not on the harrow on the other side of the contract?
Mr. SILVER. The harrow or any other article manufactured from the current is not included in the contract at all, for that is private manufacture and not a part of the contract.

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The CHAIRMAN. I know it is not, but that is what I say. Why do you include your fertilizer in it, then?

Mr. SILVER. Because it is in the tender and he agrees to make it. He did not agree to make anything but fertilizer.

The CHAIRMAN. I understand that, but you know he is going to make something else, and that is the only reason you want to give him a lease for a hundred years—because he is going to make something so cheaply, and yet you are objecting to putting in anything that will regulate anything that he has.

Mr. SILVER. Don't say "objecting." We are urging you to give him a chance to cooperate with us.

The CHAIRMAN. You are objecting just the same, because you are not asking that it be put in, but you want to put it in here where it will not amount to a damn. When it does amount to something to the farmer, you do not ask that it be put in.

Mr. SILVER. If the fertilizer business is carried out it will save upward of a hundred million dollars a year in the buying power of the farmer.

The CHAIRMAN. That is nice; that is good, but I ask you to apply the same logic to the other end of the manufacturing establishment, where he is going to make such cheap things as you have been talking about.

Mr. SILVER. There is nothing in the contract that we can talk to on that subject, for all of that must be developed by private effort and finance.

The CHAIRMAN. Exactly. Put something in, then. There is nothing in it; you do not ask that anything be put in, but if you do not want anything put in on that end of it, I do not see any sense in seeing that it is put in on the fertilizer. When I say to you that you have no regulation under this agreement, that he may put the price up, you say, "Oh, no; Ford will not do that."

Mr. SILVER. My testimony was that I had faith in our governmental institutions, and if Mr. Ford or his corporation operates it to the disadvantage of the public, our Government would protect our interests.

The CHAIRMAN. Yes; but you know that there is not anything in this contract that requires any of the output, except the fertilizer, and that is a minor thing compared to what is coming out of it.

Mr. SILVER. And whenever the public welfare is jeopardized we have the Government to act, and it will assert itself.

The CHAIRMAN. I want to be fair with you, but you know that that is not so; you know that if we regulate anything there we have to regulate everybody else just the same. You know that we regulate the International Harvester Co. now, don't you?

Mr. SILVER. Whenever the public welfare justifies it you do assert yourselves, and will in this case.

The CHAIRMAN. You know that we can not have regulation that will affect the Ford output there unless we regulate everybody else's output at the same time.

Mr. SILVER. I know you must treat them all alike and why not? Who should be favored?

The CHAIRMAN. Exactly. Now, why do you not put a provision in the contract that you can regulate the output all the way through? You will not do that; it is not popular to do it. The only place you do it is in regard to the fertilizer.

Senator HEFLIN. That is the main thing that the farmer is interested in.

Mr. SILVER. That is all he contracts to do.

The CHAIRMAN. I know that is all he contracts to do, but the thing I put up to you is why we should give him a 100-year lease and permit him to do these wonderful things that he is going to do with this electricity. Let us put it in the contract. But you say "Oh, no, you don't want to do that." You want to give something away which is not yours, but which belongs to your children.

Mr. SILVER. But, Mr. Chairman, my testimony shows that we are preserving in this method of development the rights of the development of our great natural resources for the enjoyment of all the people.

The CHAIRMAN. Then God pity the people who are to follow—the descendants of the farmers that you represent now, from the way you map it out.

Senator HEFLIN. Mr. Chairman, the farmers are more interested in the fertilizers than anything else, and Mr. Ford offers to make fertilizers, and says he will not charge over 8 per cent over the cost of production. That means a great deal to the farmers of the country, and if he did not make anything else but that, that is all they are interested in, and if he does make anything else, that is all they are interested in now, because they do not know what else he is going to make; but they do feel justified in indorsing his proposal when he does agree to make fertilizers at a profit of not more than 8 per cent. That is the way they feel about it. That is the way Mr Silver feels.

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The CHAIRMAN. In this you have the fertilizer, and you fellows are honest in what you are trying to do here. You want that in because it is going to protect the farmer, on the agreement that he will not make more than 8 per cent. You are willing to do that with this sanctimonious corporation that you propose to have; but if it is good for fertilizer, then make it good for every kilowatt of electricity that is developed by those government dams and I remove my objection. Make it good all the way through, or do not put it in at all. If we will not make any regulation about the output of those dams and the electricity that is made from that water that belongs to the people of the United States, you are going to let Ford or his corporation make a 100 per cent out of it if they can, and then you say, when we object to that, "Why, it is Ford, and of course he would not do anything like that; he has a reputation; Ford has done great things," and then to show your own good faith, apparently, you say, "We will limit the fertilizer proposition to 8 per cent." Why stop at fertilizer? Everybody knows that unless some big improvement is made in the development of fertilizer, he never will make 8 per cent on the fertilizer proposition, and all of this monkey business about it from the various farmers' organizations won't amount to a snap of the finger.

Senator NORBECK. We had some testimony here that this large corporation that is manufacturing cyanamid has never paid a dividend on its common stock; that they have paid 6 per cent on their preferred stock, but they have missed some dividends, and at the present time are practically idle, because they are unable to make 6 per cent at Niagara Falls.

Mr. SILVER. I wonder if that is not accounted for by the fact of the high price at which they sell their goods, and that at the present time the farmer is so prostrate financially that he is unable to pay the price? If they operated on the basis we urge they would run and serve the people and earn dividends.

Senator NORBECK. But any corporation would prefer to sell its product at a low price rather than lie idle. A low price will permit the farmer to purchase to some extent.

Mr. SILVER. I think so, but they are on the old basis.

Senator NORBECK. But there is an efficient business organization that can not get its costs low enough to permit it to manufacture.

Senator HEFLIN. But Dr. Whitney testified the other day on the subject of fertilizer, and he said in 1920 the supply was nearly 8,000,000 tons and in 1921 it was just about 4,000,000 tons.

Senator NORBECK. Yes; and they did not buy all of that.

Mr. SILVER. And the other fellow did not make a profit and could not buy the goods. Here is a proposal to reduce cost factors.

Senator NORBECK. Here is a proposal to give them 8 per cent when the other fellow is working on a 6 per cent basis and they can not go ahead.

Mr. SILVER. It does not guarantee him 8 per cent or any other amount; only limits the earnings to that.

The CHAIRMAN. Let us strike that out of the contract and say to Mr. Ford: "We do not want to put that in about limiting you to 8 per cent, because we have confidence in you and have faith in you." Just because it is Ford you will not have a limitation in it. It does not amount to anything anyway except as a talking point. That is all it is there for. If it is in there in good faith, then put it all through the contract and make it apply to everything. If you do that, you have removed 90 per cent of the objection to this kind of a proposition.

Mr. BOWER. Of course, there is this difference, that on the fertilizer end of it you have a plant that you built under a section of the national defense act.

Mr. CHAIRMAN. Yes.

Mr. BOWER. And you built that plant to make fertilizer.

Senator NORBECK. Are you referring to plant 1 or 2?

Mr. BOWER. No. 2 principally. Just considering that phase of it in the Muscle Shoals development, there is water power, and there is a fertilizer plant. Mr. Ford proposes to relieve the Government of what a great many people have called a white elephant, a burden on the Government's hands, and he will take the fertilizer plant as well as the power. You have not a harrow factory or a plow factory down there, or a steel factory or a glass factory. If those things are built down there, Mr. Ford is going to build them.

Senator NORBECK. Now, why should we give him more current than he needs for the fertilizer if he is not going to build these other things?

Mr. BOWER. Well, my point is this, that at the fertilizer factory which you have built and which he takes over and agrees to operate he limits his profits because that has been built there and is furnished to him at a low price, as in the contract: but there is no glass factory there.

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The CHAIRMAN. Suppose he puts up a glass factory, just as the Senator says. If we can regulate the price that he makes out of fertilizer because we build the fertilizer plant, why can we not regulate anything that is using water that belongs to us and that has been developed on money that the taxpayers of the United States have had to pay? Why not regulate the price right through?

Mr. BOWER. I don't exactly see how you would do it. We don't know what his products are going to be.

The CHAIRMAN. We could do it under Ford's offer. There is no doubt about it. We could do it, whatever it was.

Mr. SILVER. What would you regulate the price on, Senator?

The CHAIRMAN. On anything. In my bill you will find it is provided for that anything that is developed in the way of water power there shall be regulated by public authorities and not be given to one man or one corporation to the exclusion of everybody else, without any regulation as to the price, but absolutely free.

Senator NORBECK. I think Ford has carried you plumb off your feet. I think he has done wonderful, Ford has, and I think that is very good, but I would rather we would arrive at a workable contract.

Mr. SILVER. Here is a tender that sets out certain things. He make tender for so much money and certain other things, and among those other things he is going to do in purchase of the Government property is that he will keep it ready for the Government, and, in the meantime, he will manufacture under certain conditions. That is Mr. Ford's tender. That has no relationship to other things that would be done under the contract.

Senator NORBECK. Why should we give Ford other water power for other purposes? Don't we give him enough when we give him the factory? Why should we go on and give him some more property?

Mr. SILVER. I can not speak for Mr. Ford.

The CHAIRMAN. There has not been anybody here that can. They are all for Ford, but nobody can speak for him.

Mr. SILVER. But would Mr. Ford be interested in the fertilizer end without the other?

Senator NORBECK. Hope springs eternal in your breast, but it will get you a lot of grief if you live a while.

The CHAIRMAN. I would like to take Mr. Bower's proposition that he made a while ago. He said the reason why we could regulate the cost of fertilizer and not the other things is because the other things would be Ford's when he built them; but Mr. Bower forgets in that proposition that from the very beginning the Government loses title to nitrate plant No. 2 and all that property. Mr. Ford buys it.

Mr. BOWER. He buys it at a price that justifies regulation.

The CHAIRMAN. He buys it at a price that justifies regulation? Why, he pays $5,000,000 for property that cost about $100,000,000. Why, there is more than $5,000,000 in value, if you would take the scrap value of everything that he buys, and it would be cheap indeed at $15,000,000.

Mr. BOWER. Would that justify the regulation?

The CHAIRMAN. He gets it so cheap.

Mr. SILIVER. That is the point.

The CHAIRMAN. He gets the other cheaper still. He does not pay $5,000,000 for the water power.

Senator NORBECK. Mr. Silver, on what does Ford get 8 per cent?

Mr. SILVER. On the manufacture of the fertilizer.

Senator NORBECK. How do you compute your costs?

Mr. SILVER. That is what is set up by the tender for this board to do. Here are seven farmers of nine on the board. Whatever they will take into consideration.

Senator NORBECK. I mean how do you compute his manufacturing cost and his investment?

Mr. SILVER. Of course the greater the investment the greater would be the interest charge. The capital invested would be one of the items to be considered.

Senator NORBECK. What is your basis for figuring that?

Mr. SILVER. And the higher the sale price would be, the higher the manufactured product would be, so far as the product goes under this contract.

The CHAIRMAN. He has made that perfectly plain, has he not, Senator Norbeck, on what the 8 per cent is going to be based? Don't you understand that now?

Senator NORBECK. No.

The CHAIRMAN. Well, that is funny. Anybody who will read that record will wonder why you do not understand that after that explanation.

Senator HEFLIN. I don't think you let him get through.

The CHAIRMAN. Oh, yes; he was through.

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Mr. SILVER. There is no doubt in my mind that when this committee is set up, and with the broad authorization contained in the tender they will see that the public interest is properly protected.

Senator NORBECK. As the contract permits them.

Mr. SILVER. Yes; under the authorization they have. Is not that authorization a reasonably wide one and full?

Senator NORBECK. What does the contract say the 8 per cent shall be computed on.

Mr. BOWER. Fair actual annual cost of production.

Senator NORBECK. What do you figure the investment? What is your basis of figuring on that? Where do you start in? Where do you get your investment figures?

Mr. BOWER. That would be what he paid for the nitrate plant.

Mr. SILVER. That is one the items.

Senator NORBECK. What is the relation of the one plant to the other one under this contract——

The CHAIRMAN. Or to the railroad?

Senator NORBECK. Or to the railroad.

The CHAIRMAN. Or to Gorgas?

Senator NORBECK. What does he actually pay for the nitrate plant, and what does he pay for the other property? Where would you get the actual investment charges?

Mr. BROWER. It seems to me that under the contract that would be up to this board.

Senator NORBECK. Now, we want you to point that out in the contract. I have been unable to find it. If you will find it you will help the committee very much.

Mr. BOWER. Certainly what the capital charge would be would be one of the factors of the cost, would it not? You will agree with that, Senator Norris. Then the board shall determine what has been the cost to manufacture. To determine what has been the cost, the board would have to determine what is the capital charge.

Senator NORBECK. What is Ford paying $5,000,000 for? Is it for the nitrate plant or is it for the railroad?

Mr. BOWER. It is for the whole thing. That would have to be adjudicated by the board.

Senator NORBECK. Is there anything in there that authorized the board to adjudicate that point?

Mr. BOWER. I think so.

Senator NORBECK. What is it?

Mr. BOWER. "The board shall determine what has been the cost of manufacture."

Senator NORBECK. But the cost of manufacture, yes. Is there room for two opinions on that?

Mr. BOWER. Don't you think that the capital charge is part of the cost of manufacture?

Senator NORBECK. Certainly, but what is the capital charge. What is the capital charge on this thing?

Mr. BOWER. Then don't you think in determining cost of manufacture the board would have to determine the capital charge?

Senator NORBECK. It would be $10,000,000 less than nothing, according to the chairman's statement, that Mr. Ford would be getting $15,000,000 worth of property for $5,000,000.

Mr. BOWER. It is not a question of what the property is worth; it is a question of what Mr. Ford paid for it. That would be his capital charge, and in case of dispute, if the board and Mr. Ford can not agree as to what is a proper capital cost to charge on this cost of manufacture, it goes to the Federal Trade Commission for decision.

Senator NORBECK. Do you really feel that, now—Mr. Ford is a good man and he has done splendid things, and I don't hold it against him that he charges $600 for an automobile that costs him $130 to build. I don't hold that against him, but if somebody else did that we would raise Cain.

Senator HEFLIN. Others charge $3,000 for them that don't cost $300.

Senator NORBECK. But will that good spirit continue for a century after the man has left this earth?

The CHAIRMAN. Sure it will. This corporation is going to have a soul.

Mr. SILVER. The confusion of the individual with the principle of developing a natural resource, of course, is interesting, if no more.

Senator NORBECK. What is that?

Mr. SILVER. The confusing of the individual with the development of a natural resource on a new method is interesting.

Senator NORBECK. If Ford was going to do what Senator Heflin thinks he is going to do; if I knew that, it would simplify the matter a great deal with me, but why

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should not Ford like any other business man say what he is going to do and have it put in the contract. If he sells me an automobile he gives me a contract. If I take an agency he gives me a contract. He doesn't say, "You give me $10,000 and I will sell you some cars."

Senator HEFLIN. He sets the whole thing out here in a contract, to manufacture fertilizer at 8 per cent profit.

The CHAIRMAN. I will tell you another thing he does too, Senator. If you are an agent and you buy cars you pay cash.

Senator NORBECK. He applies business methods.

The CHAIRMAN. Sure he does. There are just two difficulties. One is, as Senator Norbeck says, he does business on business methods, and he will apply business methods to us when he gets this contract, and the other is that there is grave doubt about his living a hundred years.

Senator HEFLIN. The farmer is a business man and he feels like his business will be greatly benefited by Ford getting this proposition and manufacturing fertilizers.

Senator NORBECK. I don't think the farmers have gone as far as you do. There was not a single one of them that said, "Shut your eyes and take Ford's contract." Those resolutions were qualified and they were carefully drawn. I think your position is different from these resolutions that you presented to start with. I think you have gone further. I think the farmer out in the country who wrote that stuff wrote it guardedly, but I think you are wanting us to "Shut your eyes and sign."

Mr. SILVER. Read those resolutions in connection with my testimony, and if you are still of that opinion I would like to dicuss it with you.

Senator NORBECK. I am sure that a number of those you put in the record do not go as far as you do. I am sure of that.

Senator HEFLIN. Would you not like to discuss them with him before a convention of farmers?

Mr. SILVER. They would do the discussing, I would not.

Senator NORBECK. I would ask you six questions before the convention of farmers, and you would be explaining all the rest of the afternoon and all the evening.

Mr. SILVER. I am not a bit uneasy about the questions you would ask the farmers' conventions. They would answer them all right, but how would you answer their question, for they will have questions for somebody when this matter fails.

Senator HEFLIN. They would be asking who sent him out there, wouldn't they?

Mr, SILVER. They would attend to him all right.

Senator NORBECK. I always found the farmer a pretty hard-headed fellow. I give them credit for being able to take care of their own row.

Mr. SILVER. Shall I continue, Mr. Chairman?

The CHAIRMAN. Yes.

Mr. SILVER. Said board to determine cost and allowed to regulate price, to limit profit to 8 per cent as above, shall have access to books and determine territorial distribution and regulate sale to farmers, their agencies, or organization.

Paragraph 17 gives the Government full right in time of war to use plant and personnel of the company to manufacture explosives with reasonable compensation. Gives Government free access to plant at all times for confidential study and inspection.

18. At end of lease, should Government elect not to operate, the company shall have preferred right to negotiate a new lease on terms as may then be prescribed by Congress.

Paragraph 19 provides method of action in case of violation of any of the terms of the contract.

20. Submitted in whole and not in part and upon acceptance binding upon the United States and upon Mr. Ford, his heirs, representatives, and assigns and upon the company, its successors and assigns. Contracts, leases, deeds, and other instruments to be duly executed and delivered.

In talking about less cost factors and the joking that has been done about the situation which might exist, I would like to read into the record just one illustration of what has taken place.

Reading from the record of the company, that would cause me to believe that certainly this does not make the situation any worse, and there is a very strong belief in my mind and many others, that it will be a very much better situation. I refer to a memorandum taken from a book by J. H. Bridge in connection with the organization of the United States Steel Co.

On March 1, 1900, the balance sheet of the Carnegie Steel Co. showed a capital investment of $25,000,000 with a surplus of $56,579,914.19, and a total assets of $101,416,802.43 But the actual capital invested was only $25,000,000.

The CHAIRMAN. Now, what was the total?

Mr. SILVER. The total assets, or capital? The total capital was $25,000,000.

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The CHAIRMAN. The total assets?

Mr. SILVER. One hundred and one million and some odd dollars.

The CHAIRMAN. All right.

Mr. SILVER. That was on March 1, 1900.

On March 30, 1900, the same year and same month, the Carnegie Steel Co. declared a final dividend of 88 per cent, or $22,000,000, which was used to secure control of H. C. Frick Coke Co.

Following this organization the Carnegie Steel Co. was capitalized at $320,000,000, of which $160,000,000 were bonds and $160,000,000 was stock. All grown from the $25,000,000 of the original Carnegie Co.

When the Carnegie Co. went into the United States Steel Co. this $320,000,000 of capital bearing interest became $492,556,160, as follows:

One hundred and sixty million dollars of Carnegie bonds became $160,000,000 of United States Steel bonds.

Ninety-six million dollars of Carnegie stock became $144,000,000 of United States Steel bonds. That stock went into bonds in United States Steel.

Then $64,000,000 of Carnegie stock became $98,277,120 of preferred stock of the United States Steel, plus $90,279,040 of United States Steel common stock. That was $188,556,160, all in one year's time. Within about a year's time that $25,000,000 of capital builded from the Carnegie Co. into the United States Steel into $492,556,160.

Senator NORBECK. The one redeeming feature was that Carnegie gave the money back to the public, didn't he?

Mr. SILVER. I am going to read about the income feature of it to show where the money came from that went back to the public, in just a minute.

On June 12, 1919, the United States Steel Corporation has outstanding $413,010,000 bonds, $360,281,100 of 7 per cent preferred stock, and $508,302,500 of common stock. Now, this common stock was water pure and simple, and a part of that preferred stock.

Now, I will read, just treating with the preferred stock, and that was partly watered, and the common stock, which was all watered, with the earnings on that, which answers your question, Senator Norbeck.

Through the pool methods and Pittsburgh plus and so forth, in 1909 they earned $21.94 on the preferred and $10.59 on the common.

In 1909 and 1910 they earned $24.26 on the preferred stock and $12.23 on the common.

In 1911 they earned $15.35 on the preferred and $5.92 on the common.

In 1912 they earned $15.05 on the preferred and $5.71 on the common.

In 1913 they earned $22.05 on the preferred and $11.05 on the common.

In 1914 it was $6.52 on the preferred and nothing on the common.

In 1915 it was $21.05 on the preferred and $9.96 on the common.

In 1916 it was $75.37 on the preferred and $48.46 on the common.

In 1917 it was $62.23 on the preferred and $39.15 on the common.

In 1918 they earned $38.17 on the preferred and $22.01 on the common.

The last couple of years I did not have, Mr. Chairman, but I would be glad to insert them in the record, as I think I can have them shortly.

The CHAIRMAN. All right.

Mr. SILVER. Which illustrates, by the methods which they used, that the public is victimized. How much distress those millions or hundreds of millions of dollars unfairly wrung from the people caused.

The CHAIRMAN. Exactly. Now, in order to prevent that I am insisting that we should put something in the contract that the Ford corporation can not do that, and you are saying "No, no; that is not necessary because the people will regulate that." Now, we haven't regulated the steel very well, to prevent that, have we, and do you think we will do any better with the Ford Corporation.

Mr. SILVER. I believe that the public conscience and public interest in these things is regulating business to-day as it never did before, and at the same time if this tender is accepted develop a competition in this business which the public badly needs at this time.

The CHAIRMAN. You have just been demonstrating the way we regulate now the enormous profits that you have shown from the Steel Company there, on most of it water. It is an outrageous thing.

Mr. SILVER. I am illustrating what is going on and ought to be stopped and supporting a plan that will cut the cost of producing steel one-half and at the same time cut the cost of fertilizer to one-half cost.

The CHAIRMAN. You propose to stop it by refusing to put anything in this contract so as to let future generations regulate it like you are regulating it now, and what we want to do, who want to protect the people, and particularly the farmers, is to put something in the contract that will enable us to regulate these enormous

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profits that this corporation is going to make, so that some future representative of the Farmers' Union—for you will be dead—won't be able to come here and say on account of what was shoved through Congress by Members of Congress who did not attend to their business, urged on by Silver, the respresentative of the farmers, this Ford corporation ran along for a few years and then Ford died, and this year they made 100 per cent on the common and 200 per cent on the preferred, and next year 200 on the common and 300 on the preferred, just like you have been showing to-day. That is what will happen then unless now we will keep the title to this property in the Government and protect the people who own it by the contract, which you do not want us to do.

Mr. SILVER. It is hardly fair to put it that way, for everything I have said here I have said and put as I believe to be following out the instructions of the people who sent me here, and I have tried to carry out their wishes in the matter, and just so far as they wish to go it is my wish to go, and as far as I can justify with their thoughts and actions, their reason, and mine, in asking that this matter go in as a whole was to give the basis of their conclusions and the facts that they considered.

Now, to go a little further——

Senator HEFLIN. Before you leave that, Mr. Silver, you understood that the Government, in the first place, wanted to have a nitrate plant so that it could be free from dependence upon Chile and other foreign countries?

Mr. SILVER. Or anybody else; we would have it within our own borders and be in that matter self-contained.

Senator HEFLIN. Yes. Now, then, we have the nitrate plant built. Then the farmers said, "Why not use it to make fertilizers in time of peace?" Is not that true?

Mr. SILVER. Yes, sir; that is true.

Senator HEFLIN. They said they would like to have that done.

Mr. SILVER. That is true.

Senator HEFLIN. Then Mr. Ford comes along and says, "I will make fertilizers in time of peace, and I will make them at a reasonable price. I won't demand over 8 per cent profit."

Mr. SILVER. Yes.

Senator HEFLIN. Now, he agrees to do that with regard to fertilizer?

Mr. SILVER. Yes, sir.

Senator HEFLIN. Suppose he wants to spin cotton down there or to make automobiles or binders or reapers, or whatever the chairman said awhile ago; would it not be unfair to make him put in the contract what he would sell those products for, when he would be in competition with other people who would not be bound by the Government?

The CHAIRMAN. Why not the same with fertilizer?

Senator HEFLIN. He does not say what else he is going to do.

The CHAIRMAN. Why not make him say?

Senator HEFLIN. Why should he be required?

The CHAIRMAN. Why surrender this valuable heritage of the people to a man who won't tell what he will do with it?

Senaotr HEFLIN. He says he will manufacture fertilizer.

The CHAIRMAN. At least say, "No matter what you do, we will limit your profits to 8 per cent;" then we come somewhere near it. You would do that in a minute if Ford said that would be the right thing to do, and if Ford came here to-morrow and repudiated the 8 per cent on the fertilizer you would all denounce it.

Senator HEFLIN. Even if he would leave it out I would believe him and trust him to sell it cheaper than the fertilizer trust is selling it to-day.

The CHAIRMAN. So would I.

Senator HEFLIN. And the farmers would not be hurt any.

The CHAIRMAN. I would agree with you there, and I would agree to the same thing, and again we come back to the proposition, if you can guarantee he will live always——

Senator HEFLIN. He will live 15 or 20 years.

The CHAIRMAN. It will be ten years before this thing can be running right.

Senator HEFLIN. If we can get rid of the fertilizer trust in ten years, it will be worth all that you can do for Ford.

Mr. SILVER. May I just develop a thought without interruption? I ask that question frankly.

The CHAIRMAN. Certainly. You have the right to ask that, Mr. Silver, and the Chair will protect you and you need not be interrupted at all, and you can go on just as you want to.

Mr. SILVER. There is on the statutes of the country at this time a water power act. Under that water power act anybody may make and apply and, without saying any-

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thing about what he is going to manufacture and do as long as he complies with the contract with the Government as to the construction and building of dams at private investment, and building those costs up which are high-cost factors, and result in issues of bonds, issues of stocks, and so forth, just as far as they will earn, or that they can make it earn, but then the proposition comes here that we will just ask the reverse of that and we will develop a water power under Governmental authorization which will provide, in addition to other things, that it be on the amortization plan, and that it will step down and make less cost factors throughout, so that the articles that may be manufactured will have a less cost factor, and can be sold to the farmers cheaper, and in addition to what may be manufactured or produced there, that it will set a new method of development that will make it possible, when other water powers are developed along that line, to carry electricity to our homes, that we may scrub our floors, wash our clothing, take our cattle to water by pumping water to them, do the hundred and one things that can be done by this electricity.

Electricity can be made a cheap raw material to take the drudgery out of farm life, and in addition to that, under this cheap current we can operate our railways and make the cheapest freights we ever had, for under the operation of railroads by electricity it has been shown that the cars, at least freight cars, can be moved—to illustrate, on the Chicago, Milwaukee & St. Paul, with the electrified part, some seven or eight hundred miles, the electric engine pulls the same train 14 miles a day that steam pulls 7. In that way it economizes so that the freight cars will do, barring the time they may be stopped, twice the service. It cuts down the investment in this equipment, makes a greater service on that rolling stock, a greater service of the roadbed, and 25 per cent of the cars that are used on the road carry coal for the road. It would free that 25 per cent, plus the fact that you will move them twice as fast, which means 50 per cent, or, in other words, that one car then will do the work of four as now operated, so there would be a great saving in investment in rolling stock, sufficiently great in many instances that it would provide the necessary funds, instead of building new rolling stock, to develop the water power that they might be electrically operated, all of which would result in the possibility of cheaper freights, which is one of the most desirable things in our national life at this time.

I would like to quote from the superpower survey:

"ADVANTAGES OF RAILROAD ELECTRIFICATION.

"Unified operation by electricity, on the other hand, would give much better conditions than any that could possibly be attained under unified operation by steam. There would be a new motive power, in which all units or parts designed for similar service would be identical and interchangeable. There would be pooling of all power, with great reduction of reserves. Repair shops would be consolidated and all maintenance would become a standardized manufacturing job. Track capacity would be greatly increased and certain tracks would be allocated to freight or passenger service exclusively. All the freight trains would be run on schedule; the average speed would be more nearly the same and would be increased at least to the 12.5 miles an hour needed to avoid the present punitive overtime payments. Engine-house facilities would be much simplified by consolidation.

"The reserves of men and of machinery required for joint operation will be much less than the aggregate of the separate reserves required for individual operation. The great waste involved in the maintenance of separate reserves of motive power is exhibited by the operating statistics of the roads, quoted elsewhere, which show that the average freight locomotive in this territory is in productive service only 3,250 hours out of the 8,760 hours in a year, and the average passenger locomotive only 2,630 hours. With joint electric operation and consequent unification of types of motive power there would be a striking improvement. The steam locomotive runs 8 hours a day; the electric locomotive 20 hours.

"Some of the advantages of electric operation are the conservation of national resources, both of coal and labor; an increase in the capacity of main and yard tracks; an improvement of the physical condition of terminals and an increase in the value of the property, as shown by the New York Central and Pennsylvania terminals in New York City; benefits both to the traveling public and to residents along the route through the elimination of noise and smoke; the possibility of providing multiple-level terminals and freight warehouses; and economy in operation through the use of fuel and machinery for generating energy by a few skillful operators in economical stations as contrasted with a large number of technically ignorant operators with small, uneconomical machines.

"The electric locomotive is equipped with meters that afford complete knowledge and control of operating conditions and that are also a valuable guide in handling the

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train, particularly in starting a long, heavy train. With electric traction the economy of the entire sequence of operation is not dependent upon one man, as it is with steam. Operation is therefore no longer a matter of individual human judgment, skill or fidelity. It is this unfortunate human element that nullifies the theoretical advantages of the 'full-jeweled movement' steam locomotive. The effectiveness of the devices for increasing efficiency and capacity, such as brick arches, superheaters, stokers, siphons, automatic fire doors and power reverses, necessarily depends on the intelligence and faithfulness of the average engineer, and in consequence the average results are low. The inherent wastefulness of the steam locomotive is proved by its own advocates in their claim that '40 per cent of its coal can be saved by the careful use of these auxiliary devices.' Then why be skeptical of a saving of 60 per cent by a modern power station, which has all these devices in greater completeness and in addition, has brains to use them?

"The speed of different classes of trains will be more nearly uniform. Much heavier trains can be handled, and at the same time light freight trains can be moved at the speed of local passenger trains. It has been proved that for the heaviest freight service, such as mountain grade work, the electric locomotive is superior to the steam locomotive, but its superiority in handling light freight at high speed is not so generally understood.

"As the electric locomotive is simple and as all locomotives of a given class are identical and no more skill is required to operate them than is demanded of an ordinary chauffeur, all locomotives will be pooled, so that the total number required will be materially reduced.

"The flexibility of the electric locomotive is much greater than that of the steam locomotive. Its capacity is determined by heating and therefore by the average work it has to do, and not by the maximum grade, which is taken care of by the overload capacity of the engine. With electric traction the maximum grade for the profiles within the superpower zone is practically eliminated as the determining factor in locomotive equipment.

"The availability of the electric locomotive for service is at least twice as great as that of the steam locomotive. After a trip it can be thoroughly inspected in less than an hour, whereas the thorough inspection of a heavy steam locomotive consumes 4 to 10 hours. It requires no water, fuel stations, ashpits, or turntables. The repair shop capacity requires less than a third of that needed for steam locomotives. The expense of track maintenance is reduced and the ballast is cleaner. The engine-house expense is reduced nearly to a negligible amount. In the electric locomotive energy can be re-generated where the profile permits it, thus saving some energy and much wear and brake shoes, bettering the handling of trains and consequently saving expense in freight-car maintenance.

"As a result of these and other advantages the electric locomotive should, under favorable conditions, handle twice as many ton-miles as the steam locomotive per locomotive year. On the Norfolk & Western it actually handles three times as many ton-miles. This gain is not possible under all conditions; but it is possible where the traffic is great and the tracks, yards, and terminals are congested, as they are in the superpower zone.

"Electric traction, then, gives increased capacity of maint rack, yard track, and locomotives with reduced cost of operation and maintenance per ton-mile and per passenger mile." (Extract from report of Chief Engineer W. S. Murray on the superpower survey.)

The CHAIRMAN. Now, are you ready to be interrupted?

Mr. SILVER. All right, sir.

The CHAIRMAN. Now, Mr. Silver, did it ever occur to you that that was a mighty good argument against the acceptance of the Ford proposition here, that you have just made?

Mr. SILVER. I made the statement of fact and belief for whatever interpretation you seek to put on it, but to my mind supporting the acceptance of the Ford tender.

The CHAIRMAN. I want to put my interpretation on it now. I agree in what you have said. I want to see all this development.

Senator NORBECK. That is what the chairman is trying to do under his bill.

The CHAIRMAN. You bet; that is what I am trying to do, and I want to do that with every stream in the United States. You have said it very beautifully, and I want to show you why if we do what you want us to do it never can be brought about. In the first place, you started out by referring to the general dam act, which limits everything to 50 years. I don't think the Government is sufficiently protected in that act. Here you are asking for 100 years, which is a mighty big difference.

You wanted to wash your clothes as one of the things. Future generations will say, "Why can't we have this electricity to do our washing at our homes?" And they will

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say, "Why, Congress gave it away. They gave it to a private corporation, or to Henry Ford." If we do the same with other streams as you want us to do with this, with Mr. Ford or any other interest, you would not have this electricity with which to wash your clothes and pump your water, and this transportation that you describe so magnificently can not be done at Muscle Shoals if we accept this contract. You can not wash your clothes with any of the electricity developed at Muscle Shoals if we accept this contract. We can not do a single one of the things you have enumerated if we do what you want us to do. We can not use this Muscle Shoals power for any of those things if we do what you want us to do.

Mr. SILVER. Mr. Chairman, just there you indicate the weak spot in your viewpoint; what I believe is the weak point, and that is this: The development of Muscle Shoals is only one small part of the water development in this country, and we realize that we can not wash our clothes, we can not sweep our floors, we can not pump our water, we can not cut our ice, and so on, with the electricity developed at Muscle Shoals; but if we develop Muscle Shoals on this amortization plan we will set in motion the method of development that will make a cheap raw material of electricity and make it cheap enough in the development of other water powers that we can have a cheap enough basis that we will be enabled to buy it with cheap priced commodities.

The CHAIRMAN. In other words, you want to use this as a precedent?

Mr. SILVER. Yes, sir.

The CHAIRMAN. And that is one of the reasons I am against it, because it is a bad one. That means that we would do over again whenever we got the opportunity just what we are doing to-day at Muscle Shoals. That is what a precedent means. The next man that comes along you will investigate far enough to find he is a good Christian man, moved by the very best of motives, and he is 60 years old, with chances that he will live 10 years, which will be 5 years after the development is completed, and you will give to him the Yellowstone, and you will give to another man who will show he is a good Methodist and square with all his neighbors the development of the Columbia River, which has got more power than this has, and you let out all the streams clear around, and in no instance will you make any provisions for the control of the sale of the electricity that is developed. Now, that is what you want us to do here, and if we follow that plan out all over the country, God save the people that must come after us. The corporations will own it all, will have all of it, without any exception. That is just what you are asking us to do.

Mr. SILVER. It is unfair to read into my mouth language which I have not used nor principles to which I do not subscribe.

The CHAIRMAN. I don't want to do that, Mr. Silver.

Mr. SILVER. I have said all the time that I have confidence in our institutions and in our people; that they will have proper control of our national activities, and for 15 years I have fought to preserve to the peoples' use the water powers of my home State, as I am doing here.

The CHAIRMAN. Oh, yes; put that in. I have not denied that.

Mr. BOWER. And if power is sold it is regulated.

The CHAIRMAN. No; you don't regulate this. You said that we can develop the whole country, and this is the way to develop it, like we are going at it here now. I think that is a fair statement of what you said. That is what I am afraid of; that this is going to be used as a precedent for every unconscionable corporation that will ever come along in the future, and if we are going to develop the water resources of the country on this basis we will not have preserved a single right of the people to control the price of electricity, and you can not wash your clothes nor scrub your floors nor run your trains nor pump your water, nor do anything else unless you pay tribute and pay the price to the corporation that has control.

Mr. SILVER. Senator, you do regulate further under this tender than the power under the general dam act, and, besides, it has the same State control as the same kind of business under the general dam act.

The CHAIRMAN. As I said, there are a lot of things in the general dam act that I do not like, but under the general dam act, my dear friends, the man who develops it, the lessee, is subject to the control of the State, if there is such a regulation in the State where it exists, in the sale of the power, and if not, then he is controlled by the Federal commission. In this case it is admitted, to begin with, that there is going to be none sold, and admitted, to begin with, that the Alabama commission will not have any authority whatever over Mr. Ford or any of the electricity that he generates, if he does not sell it, and he is not going to sell it.

Mr. BOWER. I notice in reading this section of your bill that your regulation is a regulation of the resale of power.

The CHAIRMAN. Yes, sir.

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Mr. BOWER. You don't propose to regulate what any of these purchasers of this power shall make?

The CHAIRMAN. No, sir; they can make anything they want to.

Mr. BOWER. Then you won't regulate it?

The CHAIRMAN. Not what they make, but I regulate the price that they will have to pay.

Mr. BOWER. You are regulating the price that the buyer of power will have to pay?

The CHAIRMAN. I am not in favor of a law that would say that you shall do this or that or any other thing. I do say as between an individual or a corporation and a municipality, where the public want it, the municipality shall be the favored bidder. They shall give it to them in preference to the private party.

Mr. BOWER. I got a wrong interpretation from your statement, that if this power was sold under your bill you did regulate the things that were made by that power.

The CHAIRMAN. No.

Mr. BOWER. Then that is the same as the Ford proposal.

The CHAIRMAN. Oh, no; it is not. Ford does not sell any. He is going to keep it himself.

Mr. BOWER. But the people you sell this power to won't sell any power.

The CHAIRMAN. But the corporation that handles it is a corporation owned by the Government of the United States. I am not objecting to a monopoly if the Government owns it, but I don't want a monopoly that is privately owned.

Mr. BOWER. And they sell this power to a manufacturing concern to do it cheaply.

The CHAIRMAN. And they provide the amount of profit in it, what the resale price shall be.

Mr. BOWER. Of power.

The CHAIRMAN. Yes.

Mr. BOWER. Not on what they manufacture.

The CHAIRMAN. All right—the power. If you say in here that Ford's corporation shall pay a certain price for this power, if he gets it, in competition with others, and make him sell the power to municipalities and cities and to counties and public organizations of that kind, and let it be regulated by the Alabama authorities, then it is relieved of its objectionable features. You have not taken away, of course, what to my mind is an insuperable objection, and every conservationist that I have ever believed in, that was not in favor of turning over the resources of the country to private manipulators, was opposed to a hundred-year contract with anybody. That is pretty near perpetual. There have been others issued, I admit, some of them that are perpetual.

Mr. SILVER. There are perpetual leases. The Tennessee River development of the aluminum company's. They are perpetual.

The CHAIRMAN. They did not get that from Congress. I do not have the blood of that on me.

Mr. SILVER. If you are requiring all that to be sold to municipalities, as you mention there, it would certainly bar the country people from getting the benefit of cheaper manufactured goods.

The CHAIRMAN. I don't regulate the use of all of it, but they would have preference. My own idea would be if we have a great dam right here at Washington, before we would permit that electricity to be used by Mr. Ford to make automobiles, it ought to be given to the people to light their homes, to cook their meals, to run their washing machines, at the lowest possible price. That comes nearer giving it to everybody, because if you give it to one man to manufacture with, and he is in competition with a man who does not have that power, all he does is to just cut under the other fellow enough to sell his product, and he makes a big profit himself.

Mr. SILVER. If there is to be no more developed, but the survey shows there is an abundance in the United States for all purposes for centuries to come if all industry were electrified.

The CHAIRMAN. It will not come in the next thousand years, probably. I hope it comes a lot faster than it has been coming, but if you have followed the fight that I have been trying to make to get Great Falls developed, right in the sight of the Dome of the Capitol, and see how it stays there undeveloped——

Mr. SILVER. Those falls ought to be developed.

Mr. BOWER. Is not that a justification of our offer on this proposition? We tried. Senator Norris, as you know, Government operation on this other proposition, and we could not get consideration of the House. They would not give us a hearing before the committee of the House on that bill. It lay there for three months, and they would not grant us a hearing.

The CHAIRMAN. That bill, in my judgment, was not anywhere as near as good as this bill, because it still left it in politics. It turned it over to the Secretary of War, a corporation organized by him. It would have been changed every time the administration was changed. But I agree that you did not get anywhere with it, and I did everything I could to have you get somewhere

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Mr. BOWER. I know you did, Senator, and we appreciated that very much.

The CHAIRMAN. I would rather do that than nothing. I think we made a serious blunder when we quit work down there at Muscle Shoals. We ought to have kept on. I am afraid when I read in the paper of some cloudburst or something, that something of that sort will come along and tear away all our work that is worth millions, and we ought not to lose a minute in getting to work there.

Mr. BOWER. Frankly, I would say that I do not see any hope whatever in the House now.

The CHAIRMAN. On conservation of natural resources I have been active all my life. I voted against the water power act because I did not think it protected our rights enough.

Mr. BOWER. I don't think there is any question but what that is one of the controlling factors in the farmers' advocating the Ford proposal, because the farmers believe that is the only way they will secure this development and are not satisfied with development as proposed under the dam act.

The CHAIRMAN. I think you are right. I think the farmers are advocating the Ford proposal, and it is perfectly natural——

Mr. BOWER. They believe in Mr. Ford.

The CHAIRMAN. Because they believe in Mr. Ford.

Mr. BOWER. That is true.

The CHAIRMAN. I said on the floor of the Senate, while I was arguing the Great Falls proposition— and they turned me down on that—that the unseen power seemed to be always sufficient to defeat every proposition we had. but the time would come when the public sentiment would be so strong, it would go the other way and it would swing so far that these very fellows would be depending on me to help defend them from the mob. Well. that time has not come. but to some extent it has come. because the plea, almost to a man. is to give this to Mr. Ford, and the only thing they know about it is that they know Ford and they like him, and I know Ford and I like him, but I feel that I have a responsibility. when it is put up to me. to investigate it to find out what is in it that is unfair, and if I find it is unfair, turn it down if everybody is against me. I am convinced it is unfair to turn this valuable thing over to a corporation without any agreement for a hundred years.

Mr. BOWER. There is an agreement as to the fertilizer.

The CHAIRMAN. I ought not to interrupt you so much, but I am so damned full of this I can't keep still. I have been in this fight for too many years. I am all worked up about it. I have seen the people defeated so often, time and time again, and I think they are about to be hornswoggled again.

Mr. SILVER. The people believe that this is an opportunity to develop a great natural resource so that they will benefit by it, and that they will be enabled to have much better things and much more enjoyment out of their natural resources than anything that has heretofore been developed or promised otherwise at this time.

The CHAIRMAN. Mr. Silver, I believe if your people, the farmers of this country, would stand by the proposition they laid down a year ago. when the committee investigated it under your organization, instead of changing around and now coming in for this 100-year corporation, and would stand together—and you are more influential with them than anybody, you are responsible more than anybody—if the farmers and your organization would all stand together, we could put this thing across now, because everybody that has looked back has realized that we have got to do something with it, and now is the time to get in our work here and do something that will benefit not only the present-day people, but the people that are going to follow. and not sign away their rights. That is what I don t like about the position you take. If you would unite your people, and we unite here. if you fellows were moved by honest motives that want to give something to Ford just because Ford is a good man, and would go with us who want to conserve the resources for future generations. and not give them away to any corporation. if you would do that. if you would be with us, you would get some legislation right away. If you will sit down and think and realize what we are going to give to this corporation in the way of natural resources that belong to our children. I can not conceive of you, as intelligent as you are, and as honest as you are down in your own heart, doing such a thing. You must know you are wrong.

Senator HEFLIN. Mr. Chairman, they realize that nothing has been done at Muscle Shoals, and they don't believe anything is going to be done now by the Government.

The CHAIRMAN. I know that, but let us convince them that the Government is going to do something. Let us go in there and do it.

Senator HEFLIN. But this is a proposition to do something now.

The CHAIRMAN. That is the trouble. We can not count on you.

Senator HEFLIN. Ford expects to go on through and do something with it, and everybody else who has attempted to do anything with it has failed.

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Senator HARRELD. You think we are about like the girl whose lover quit her and she married a tramp in sheer dispair.

The CHAIRMAN. It makes me think of the fellow defending the Standard Oil Co. He said, "Before the Standard Oil went into this business we paid 25 cents a gallon for kerosene." That is true. They have reduced it. Therefore, let them have their own way. Don't regulate them in any way at all. You say Ford made an automobile and he sold it to us cheaper than anybody else. But he made a big profit himself.

Mr. SILVER. I think he did, but owing to his business genius he gives us more for our money than anybody else.

Senator HEFLIN. That is true, but he was satisfied with a reasonable profit.

The CHAIRMAN. He ought to have been satisfied. He was making enough. He was not worth anything when he started in, and since we have been alive he has become one of the biggest millionaires in the world. He has made lots of money.

Senator HEFLIN. But all the other concerns charged more than he did.

The CHAIRMAN. You say because Ford sold his automobiles cheaper than the other fellows did and did not profiteer as much as the other fellows did, therefore, let us contribute for a hundred years this great inheritance to Mr. Ford, and let him give it away to a corporation.

Senator HEFLIN. That would be some inducement to a man who had been fair in his dealings with his fellows.

The CHAIRMAN. I admit that, all of it. I would rather give it to Ford than I would to the Standard Oil Co. If I could give it to Ford, I would rather expect Ford to do the square thing, but he can not live to carry it out. I am willing to enter into a contract now to give it to him without anything, turn it all over to him, let him operate it, let him make everything he can out of it, if he will operate this nitrate plant and sell it to the farmers and let that contract last as long as Ford lives. If you want to agree to a contract like that you can get me.

Senator HEFLIN. He would rather have it for a hundred years.

The CHAIRMAN. Well, I guess they would rather have it for a hundred years.

Mr. SILVER. Instead of, as you seem to see it, our people see a different picture of this thing, a true picture. Here are, estimating the ones that are home, some 6,000,000 and over farm homes, with the woman over the washtub once a week—it may be the mother or the daughter. There is the same number of homes with the boy or man driving the cattle to water in cold, bad weather, cutting ice in winter and doing other things, and all of those thing that would be so helpful in country life and take the drudgery out of it, can be done by harnessing and delivering this electric power at a price that the sale of their product would enable them to buy. So when we secure the adoption of this tender and the resulting beneficient and helpful development they will call us blessed.

The CHAIRMAN. If you wanted to do that I would be with you, but here you are doing exactly the opposite thing, Mr. Silver. You are saying "Turn this over to Ford." What is the woman over the washtub going to say when she sees this development here? Why, "Mr. Ford, Mr. Silver said when you got this I was going to be relieved from washing. I was going to get a washing machine and run it by electricity." Mr. Ford says, "Oh, no; I am going to make automobiles with this power. I am not going to give it to you."

What about the boy driving the cattle to water. He will say to Ford, "Silver said when you got this I would have power to pump water with. Silver said I was going to get it after you got this." Ford says, "I am going to make steel with it, and make 25 per cent profit on this. I am not going to let you have this."

Mr. SILVER. Of course you confuse your government ownership picture with the simple project of the Muscle Shoals and with the great power development of this country on the amortization basis which is the method by which the country get the benefit along with others.

The CHAIRMAN. But you say we want to use this as an example for the balance of the country. If you do, you are not ever going to reach the woman over the washtub, or the boy driving cattle to water.

Mr. SILVER. We are definitely urging one thing, namely, the fertilizer, which is one of the greatest costs on the farm, and we believe if we get the amortization feature established we will have passed a turning point in the development of natural resources that will enable us to reach these things I have mentioned, the less cost factors, which will enable the children of the farms to be better educated and to wear better clothing and have more of the home comforts, all of which are so badly needed and so much to be desired, and anything that can be done to bring that about we are anxious to see that it is done.

(Whereupon at 5:40 o'clock p. m., the hearing was adjourned to 10 o'clock a. m. Wednesday, May 10, 1922.)

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MUSCLE SHOALS.

WEDNESDAY, MAY 10, 1922.

UNITED STATES SENATE,
COMMITTEE ON AGRICULTURE AND FORESTRY,
Washington, D. C.

The committee met at 10.30 o'clock, pursuant to adjournment, in the hearing room of the Committee on Commerce, United States Senate, Capitol Building, Senator George W. Norris (presiding).

Present: Senators Norris (chairman), Capper, Keyes, Gooding, Ladd, Norbeck, McKinley, Kendrick, Harrison, Heflin, and Caraway.

The CHAIRMAN. The committee will come to order.

STATEMENT OF MR. R. F. BOWER, ASSISTANT IN WASHINGTON OFFICE OF AMERICAN FARM BUREAU FEDERATION.

Mr. BOWER. With your permission, Mr. Chairman, my name is R. F. Bower, assistant to Mr. Silver, of the American Farm Bureau Federation.

Mr. Silver, yesterday, covered the Ford proposal other than the sections dealing with fertilizer production. and I will attempt to address myself solely to that phase and what benefits the farmers believe can be secured.

There are three sections of the contract that deal with the fertilizer production.

In the first one of the three—

"The company agrees to operate nitrate plant No. 2 to the approximate present annual capacity of its machinery and equipment in the production of nitrogen and other commercial fertilizers (said capacity being equal to approximately 110,000 tons of ammonium nitrate per annum) throughout the lease period, except as it may be prevented by strikes, accidents, fires, or other causes beyond its control, and further agrees:

"(*a*) To determine by research whether by means of electric-furnace methods and industrial chemistry there may be produced on a commercial scale fertilzer compounds of higher grade and at lower prices than fertilizer-using farmers have in the past been able to obtain, and to determine whether in a broad way the application of electricity and industrial chemistry may accomplish for the agricultural industry of the country what they have economically accomplished for other industries, and if so found and determined to reasonably employ such improved methods."

Then section 16 is the one (I won't take the time to read it in full) which provides for the board, a majority of which is chosen by the President and confirmed by the Senate from nominations made by the leading national farm organizations of the country.

That sixteenth paragraph is a very striking thing when you analyze it; and I will come to that later.

This is a question which we believe is broader in its fertilizer application than most people consider. It is a question as to whether we are going to be able to maintain our soil fertility and continue to produce the crops necessary to feed this country, or whether we have got to go on in the future as we have in the past and exhaust our soils in order to produce crops; and under such a system we see inevitably a time when we can not meet the demand that is upon us. Our whole national prosperity depends upon the maintenance of our soil fertility. No country has ever continued in the history of the world longer than the time when its soil fertility has been exhausted. We have illustrations of the great nations of Babylonia and Assyria, nations which supported millions of population, sending armies over to attack Rome, and over into India, and down into Egypt, where today there is a desert waste, and where plants will not grow.

Senator NORBECK. It is not pertinent here, but of course you are willing to admit there are a great many causes that enter into that predicament.

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Mr. BOWER. There are other causes that enter into it.

Senator NORBECK. Some writers have gone so far as to say that there has actually been a climatic change in that country, and less rainfall.

Mr. BOWER. A good many scientists agree with that.

The CHAIRMAN. There is not rainfall enough there to produce a crop. I think that is admitted.

Mr. BOWER. That is true, but you must remember that the decrease of vegetation has a tremendous effect on the rainfall, and we are finding that out in these great areas where we irrigate in this country.

Senator NORBECK. Now you are getting into a most controversial point. If you can find by Government records anywhere that there has been any increase in rainfall by anything man has ever done, I want to buy you a new hat, because that is a thing I have been looking into for a great many years.

Mr. BOWER. I understand that it is a controversial question, but some scientists have taken the position that once you start crops it does have a bearing on the amount of rainfall. But that does not enter into this question at all.

It is the duty of the farmer to raise as large crops from his land as he possibly can do, but if he does that at the expense of soil fertility he is jeoparizing future production and, consequently, jeopardizing future generations.

In the Outlook of October 12, 1912, Theodore Roosevelt said:

"I have always been deeply impressed with Liebig's statement that it was the decrease of soil fertility and not either peace or war which was fundamental in bringing about the decadence of nations. While unquestionably nations have been destroyed by other causes, I have become convinced that it was the destruction of the soil itself which was perhaps the most fatal of all causes."

There has been a great deal of talk about soil fertility, and a lot of people make out that it is a hard problem, but in a way it is a simple problem.

The elements in any normal agricultural soil that are ever lacking are only three: nitrogen, phosphorous, and potash; and the only way to maintain soil fertility is to replace into that soil corresponding amounts of the elements you are taking out in crops.

Now, it is just simple arithmetic, an addition by fertilizer, legumes, manures, or some other method, and subtraction by growing crops.

The difficulty with commercial fertilizers, which I will discuss a little more fully when I get to it, has been the low grade material and the high prices charged for it. It is not genreally realized that in this country to-day, speaking from a practical standpoint, and from a general standpoint, our entire acreage of productive land is practically under cultivation to-day. We can add some few thousands or hundreds of thousands of acres by such irrigation projects as are practical. In my own State of Virginia we can drain the Dismal Swamp area, and the land will probably be very rich when drained, but that is just a drop in the bucket compared with meeting our increased food consumption demands, and consequently the fertilizer-using farmers and the use of fertilizer as an economic crop production method has no longer got to compete in this country with virgin fertile lands brought under cultivation.

Fertilizer consumption in the eastern States is very seriously handicapped and always has been seriously handicapped by the gradual westward trend of crop production onto the very fertile virgin plain in the eastern Mississippi Basin, through the corn belt, Illinois, Indiana, Ohio, etc., then across the Mississippi into Iowa and Missouri and the great wheat-producing sections of the country, but that is no longer an increasing competitor, and in fact the use of commercial fertilizers is gradually extending through that territory. It is becoming very extensive now through the States of Ohio, Indiana, and Illinois. And in Missouri they are beginning to use fertilizers. They are beginning to realize the exhaustion of their soil. The important thing in the discussion of fertilizer centers around price. That is the crux of the whole question. There is nothing else that is one-half as important; in fact, there is nothing else that is one-tenth as important as the price of the fertilizer compounds.

All the consumption estimates which have been presented to various committees studying this have neglected to consider that factor. I believe they state the use of nitrogen fertilizer doubles about every 10 years; that is, nitrogen in the commercial form. That is true, if the price is to be maintained at the level at which it has been maintained, but if you cut the price of nitrogen fertilizer compound to any extent, even one-fourth or one-third, the expansion of the use will grow tremendously, because it is largely used now on all crops where it will pay a commercial return, and the reason it is not used on wheat is because it won't pay a commercial return except on land that has got to have it in order to grow wheat; I would not recommend to any farmer in Senator Norris's State of Nebraska that he should put nitrogen at 20 cents a pound under wheat, because the increased yield of wheat on an average normal condition

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would just about break even, and if he had any climatic difficulty, like a slight drought even, he would lose the investment in his fertilizer.

But I would recommend to the farmers in Senator Norris's State of Nebraska that if they could buy nitrogen at 10 cents a pound they put it under wheat, because it would pay.

That is the whole situation as to price. That price is the determining factor of what a fertilizer——

Senator NORBECK. Price is the determining factor of everything. If land was cheaper we would buy some land, too, and it is the same thing all over the country. The question here is what is the possibility of reducing the price, and what is the best method of doing it? We will admit all that you say.

Mr. BOWER. I will come to that. But the reason I am emphasizing this is because of the position of the National Fertilizer Association in their long testimony before the House committee. I don't know whether they have requested hearings before this committee or not, but Mr. McDowell, the president of that association, was before the House committee, and he neglected absolutely the whole price phase of it. He set up what the farmers could do and should do and how it should be done. But the price phase did not enter into his mind at all.

The three fertilizers, as I have said, are nitrogen, phosphorus, and potash, and I want to impress upon the committee that of those three nitrogen holds the most prominent position. Potash is almost negligible. Phosphorus is important, but nitrogen is the crux of the whole situation in fertilizer.

Just to illustrate that, in the first place on most agricultural soils that need commercial fertilizer, nitrogen is the limiting factor of crop production. That is, it is the element that is most lacking, and it does not do any good at all to put a phsophorus fertilizer on to grow plants on soils that are lacking in nitrogen. The old illustration used by all the experiment colleges, and the best and the simplest one, is to picture the soil fertility as a barrel with three broken staves. The one broken off about one, third the way up the barrel is the nitrogen stave. The stave broken off about halfway up the barrel is the phosphorus stave. The stave broken off, say, three-fourths of the way up the borrel is the potash stave. Picture the growing of the crop as the filling of that barrel. Your crop will grow right up to the point where nitrogen gives out, and it does not make any difference that the phosphorus stave is here halfway up to the top of the barrel; the crop grows right up to the nitrogen stave, where it ceases to get the nitrogen it requires.

If you put the nitrogen stave in all the way up to the top of the barrel, the crop will grow and will reach halfway up to the top of the barrel and will stop growing where the phosphorous rock stave is broken.

If you put the phosphorous stave in it will run up clear up to three-fourths the height of the barrel, where the potash breaks through, and if you put that stave in, you get the full normal crop; and when I say normal crop, you get a crop that is normal as far as the elements of fertility are concerned, aside from the rainfall and other factors are concerned, but so far as the soil fertility elements are concerned, you get a crop that will run out at the top of the barrel.

A 100-bushel crop of corn in grain and stalk will take out of the soil 148 pounds of nitrogen, 23 pounds of phosphorus, and 71 pounds of potassium. One hundred and forth-eight pounds of nitrogen to 23 pounds of phosphorus and to 71 pounds of potash.

You may question why I said potash was negligible. In most all of our normal soils potash is a very, very heavy component of the soil itself. It is often unavailable in the form that it is in the soil, but it is there in large quantities and with proper soil treatment and soil handling the potash can be made available, so that although the crop takes out a very large amount, it is very seldom a limiting factor, and the principal limiting factor is the nitrogen and phosphorus.

In 1909 corn, wheat, and oats, three cereal crops in the grain alone, took from the soil 3,965,000,000 pounds of nitrogen, 606,000,000 pounds of phosphorus, and 875,000,000 pounds of potassium.

This nitrogen would require, in ammonium sulphate, 9,912,500 tons per annum to replace. That is a indication of the actual demand for nitrogen on the American farms. That is replaced through nitrogen bacteria acting in the soil itself, which is nature's own way; it is replaced by the growing of legumes and the plowing under of clovers, alfalfa, cow peas, soy beans, and many other leguminous crops; and it is replaced by the application of commercial fertilizer.

The difficulty with the replacing of nitrogen in the soil has been the price of nitrogen. I think right there I would like to quote from the president of the American Cyanamid Co., Mr. Frank Washburn, in hearings before the Committee on Agriculture of the House on February 9, 1916. Mr. Washburn stated:

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"I believe, therefore, that the best way in which I can contribute something of possible value to your deliberations is to confine myself in the main to what is possibly the most important single difficulty the farmers of this country face in the matter of fertilizing their crops, and the most effective single remedy therefor. I refer to the always high and frequently prohibitive cost of the nitrogen fertilizer as the difficulty and to Government cooperation in the establishment of nitrogen industry within the borders of the United States as the remedy."

Then he goes on to say:

"The answer to the fertilizer problem, to be of any practical and immediate value, must lie in revolutionizing present conditions instead of a slow evolution proceeding under their domination."

I want to refer back to that last statement a little later.

Then, with that situation, the question resolved itself into what can be done, as Senator Norbeck stated. What assurances have we got? What have we got on which to base our belief that development and operation of this plant will result in lower-priced nitrogen?

In testifying on S. 4971 before this committee of the Senate on March 16, 1916, Mr. Washburn stated, on page 5:

"What has been obtained, economically speaking, is this: That the factory costs (that is, of cyanamid) under most favorable conditions, those which are not only theoretically obtainable, but actually obtainable in some parts of the world, everything, including overhead and superintendence and all that sort of thing inside the factory, but not including interest on investment, for producing nitrogen, comparable to the nitrogen that is in the Chilean nitrates is about one-third of the ordinary market price of the Chilean nitrates.

"Senator SMITH of South Carolina. You mean to say that the factory cost is about a third of the selling cost?

"Mr. WASHBURN. Of the selling cost of Chilean nitrate."

Senator NORBECK. He meant there, if I understand the point you are trying to make, that the cost of the investment was the larger cost of the fertilizer?

Mr. BOWER. No. This was factory cost. He was giving the factory cost without including the interest on the investment, because previously we did not have figures as to what the plant investment would be.

Senator NORBECK. Is he the same man who testified before this committee?

Mr. BOWER. Yes, sir; in 1916.

Senator NORBECK. Do you mean this man who testified a week or so ago?

Mr. BOWER. That was Mr. Hammitt, representing the same corporation.

Senator NORBECK. His testimony was that they were practically shut down because they were unable to produce nitrate that would take care of their overhead. They shut down and not only failed to pay dividends, but failed to pay operating expenses, and it was for that reason they shut down.

Mr. BOWER. There are some interesting features in regard to that.

Senator NORBECK. He took the position before this committee that if costs could be reduced it would be decidedly to their advantage to run without a loss rather than to stand still and have a loss.

Mr. BOWER. Sure. There is no question about that.

Senator NORBECK. But they found themselves unable to do so; therefore they have that big investment standing idle.

Senator KEYES. Mr. Bower, does the witness whom you quoted there state what countries he refers to as "some foreign countries"?

Mr. BOWER. Yes; and he goes on and explains that this favorable location, etc., is the Muscle Shoals location. He was testifying on the Muscle Shoals development at that time before this same committee.

There appeared before this Senate committee in 1916 Doctor Baekeland, one of the great independent consulting chemists of the country, and on page 113 of hearings on S. 4971 he says:

"The statement is made by the present Government monopoly in Germany that after the war is over and after what they know now about the synthetic manufacture of nitrogenous fertilizer from the air, after all the experience they have acquired during the war while making nitric acid, that they will be in such condition that they intend to furnish to the farmers of Germany nitrogen fertilizer at about one-half the price it is costing the consumer here in the United States. If Germany can do that, gentlemen, there is not the slightest doubt in my mind that we can do the same here or that we can do better."

As confirmation of the fact that Germany is doing that I have here a brief prepared by the Koppers Co., of Pittsburgh, Pa., designers and builders of by-product coke and gas oven plants, one of the largest designers and builders of by-product coke oven plants, asking for protection on ammonium sulphate in the tariff law. One

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of the reasons why they ask for protection by legislation was the German nitrogen fixation plant.

The CHAIRMAN. Who is that?

Mr. BOWER. The Koppers Co.

The CHAIRMAN. Who was testifying there?

Mr. BOWER. This is a brief prepared by the Koppers Co. and argument in support of a duty on ammonium sulphate and ammonia products.

The CHAIRMAN. What company is that?

Mr. BOWER. The Koppers Co.

The CHAIRMAN. Yes.

Mr. BOWER. That is the largest—well, now, I am not sure whether it is the larger of the two great companies in this country who design and direct and operate under contract the great by-product coke ovens.

The CHAIRMAN. They made their product from the coke?

Mr. BOWER. Yes, sir; from coking coal, and they are asking protection in the present tariff bill on ammonium sulphate, their nitrogen product, against German air fixed nitrogen into this country.

The CHAIRMAN. Can you tell us whether they succeeded in getting the committee to put a tariff on it?

Mr. BOWER. They succeeded, Mr. Chairman, in the House committee, without a hearing, in securing $12 duty a ton on ammonium sulphate in the bill as it passed the House.

The CHAIRMAN. What did the Senate do?

Mr. BOWER. The Senate, after we had made a vigorous fight against any duty on ammonium sulphate, have reported it out with a duty of $5 a ton on nitrogen.

They cite, as one reason why protection by tariff is needed, that—

"The cost of operating these plants is relatively low, so that even to-day sulphate of ammonia is being sold in Germany at half the price in the United States, based on the present rate of exchange."

The CHAIRMAN. Of course, that is very proper evidence and I am interested in it, but they were asking there for a tariff.

Mr. BOWER. Surely.

The CHAIRMAN. Like most of these people who are asking for a tariff on their products, it is known and considered that they are vitally interested in it, and their testimony must be weighed accordingly.

Mr. BOWER. I appreciate that, but that is the testimony, and why it is so interesting to us is that it is the testimony of the opposition who come here and tell us that they can make all the ammonium sulphate we need, and that we do not need to operate the Muscle Shoals plant, and they have gotten out briefs, and I have copies of their propaganda, in opposition to the Muscle Shoals plant, saying that they can furnish us all we need at any price we want it, and then they come here and ask and get $12 a ton duty on the ammonium sulphate in the House, and they have got $5 a ton as it stands in the Senate to-day.

The CHAIRMAN. I think we are all agreed that there should be operation of Muscle Shoals, but we disagree on how to do it.

Senator HEFLIN. If they get this duty that they ask for it will increase the price of fertilizer to the farmers, won't it?

Mr. BOWER. I should think there could be no question about that and, furthermore, as I see it, with the only competitor in the ammonium sulphate industry in this country to-day being Chilean nitrates, and Chilean nitrates having a price fixing arrangement of their own and a distribution arrangement of their own, the Chilean Nitrate Association would immediately take advantage of the duty on ammonium sulphate and raise the price of Chilean nitrates accordingly.

The CHAIRMAN. That means they would increase the export duty?

Mr. BOWER. Well, I don't know whether they could do that, for this reason, that they would have to increase the export duty generally. But the Chilean association could raise the price of Chilean nitrates in this country.

Senator HEFLIN. In order to meet the price advance by this other concern?

Mr. BOWER. Exactly so.

Senator HEFLIN. Which would make the price to the farmer of a ton of fertilizer higher than it is to-day?

The CHAIRMAN. I have an idea that they would increase the export duty.

Mr. BOWER. They have the difficulty there that their whole exports are not coming to this country.

The CHAIRMAN. I know, but most of them do.

Mr. BOWER. Well, I don't think, Mr. Chairman, that quite 50 per cent does come to this country.

The CHAIRMAN. Does it not?

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Mr. BOWER. Not quite that.

The CHAIRMAN. I do not know that I would find fault with the Chilean Government for putting on an export duty. I am inclined to think if I was a citizen of Chile I would favor that too. They have a monopoly and they are making something out of it. Of course at some time it will be exhausted. That is pretty hard on us.

Senator NORBECK. They want to get theirs while the getting is good.

Mr. BOWER. The commerce reports of the Department of Commerce Daily Consular and Trade Reports of March 21, 1921, on page 1593, under the heading "German production of nitrogen fertilizers," there is the following:

"Mr. Howard W. Adams, representative of the Department of Commerce in Berlin, Germany, reporting under date of January 10, 1921, on the present situation in Germany in the production of nitrogen fertilizers by fixation of atmospheric nitrogen, writes as follows:

" 'Calcium cyanamide factories engaged in the production of nitrogen fertilizers by process of fixation of atmospheric nitrogen were in operation in Germany before the war, but during the war these plants were extensively enlarged and are now in process of completion. The total output of these plants when properly supplied with coal is estimated at 600,000 tons, with a nitrogen content of 120,000 tons. Several plants representing this production, together with the possible output of each are as follows:'"

Then there follows a list of five plants, the largest having a capacity of 175,000 tons and the smallest having a capacity of 60,000 tons.

"At the present time these plants are producing approximately 500,000 tons of calcium cyanamide, with a nitrogen content of 100,000 tons."

The CHAIRMAN. What process were they using?

Mr. BOWERS. The calcium cyanamide process.

Then they have, or had, two large plants in Germany under the Haber process, one at Oppau, and another one twice as large at Merseberg. The annual output of nitrogen in both of these plants is 300,000 tons.

The CHAIRMAN. Give the source of your information.

Mr. BOWER. This is from that same commerce report.

The CHAIRMAN. I know it is, but it does not so appear in the record when you were giving it.

Mr. BOWER. Yes. The statement about the Haber process is also from this same consular report.

The CHAIRMAN. Read that. What does he say about the Haber process?

Mr. BOWER (reading). "The Badische Anilin und Sodafabrik is the only concern producing nitrogen fertilizers by the Haber-Bosch process. Its first factory for this purpose was constructed at Oppau. Operations began at this plant in 1913. A second plant known as the ammonia works of Merseberg, which is twice the size of the Oppau plant was later erected and has been in operation since 1917. When properly supplied with raw material the annual output of nitrogen in both of these plants is 300,000 tons, corresponding to 1,500,000 tons of sulphate of ammonia."

And then it goes on to say before the war what they did, etc.

The CHAIRMAN. Read that if it has any bearing here.

Mr. BOWER. I don't know that it does.

The CHAIRMAN. We are interested in knowing what can be done with the Haber process.

Mr. BOWER. It is a very general statement, not referring particularly to the Haber process.

"Before the war Germany's annual agricultural requirements of notrogen fertilizers were 210,000 tons of nitrogen, of which 100,000 tons were in the form of nitrate of soda and nitrate of lime (imported), 100,000 tons in the form of sulphate of ammonia from home production, and 10,000 tons in the form of calcium cyanamide, likewise of home production," etc.

Senator KENDRICK. It would seem from that that Germany does not find it necessary to import any nitrogen.

Mr. BOWER. I doubt if Germany is importing any Chilean nitrate to-day. Of course, since this was written they have left only one of the Haber process plants because, as you gentlemen know, the one at Oppau was totally destroyed by an explosion that killed 1,600 people.

The CHAIRMAN. Mr. Bower, have you studied the Haber process so you can tell, or have you any definite idea about it as compared with the cyanamid process?

Mr. BOWER. No, Senator, I have not. I believe it is included in the Ford offer. I have no prejudice against the Haber process. It is the process that will make the cheapest nitrogen fertilizer for him that the farmer is interested in and we would be in favor of, and believe it is covered under the research paragraph having all these various processes researched and determined as to what is best.

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The CHAIRMAN. I think that is true under this proposal, and yet under Mr. Ford's proposal he gets title, absolute title, to the building and all the machinery that we own down there.

Mr. BOWER. In No. 1.

The CHAIRMAN. In No. 1, which is the Haber process, and there is no agreement as to what he shall use it for.

Mr. BOWER. No; but in the light of two things that happened in reference to the Haber process, I think possibly that would explain Mr. Ford's hesitancy to guarantee to operate that plant. I don't know whether it does or not. The first one is that if you will remember Dr. Arthur Graham Glasgow, who was appointed by President Wilson as nitrate administrator—and it was Doctor Glasgow that drew up bill S. 3390 and submitted it to Secretary Baker and he sent it to Congress—and Doctor Glasgow, in attempting to dispose of the nitrate plants down there went to the General Chemical Co., who owned the process, and built No. 1 plant, and offered them that plant free of any charge; they would pay absolutely nothing if they would spend, I believe it was, $500,000 a year for three years to work it out and make it work, and they absolutely refused to have anything to do with it and left it as a white elephant on the Government's hands, and went up to Syracuse and built a new Haber process plant under what they claim is an additional modification, a different change, and then when you find the Haber process at Germany blowing up and killing as many people as it did. I don't know that I blame Mr. Ford for not wanting to guarantee to operate the plant, but I do believe that under the research section of the offer, he would want to research the Haber process, and if it would work out he would utilize it.

The CHAIRMAN. The thing that caused me to suspect that he did not intend to do it was because we have that building there now, and the steam plant connected with it, and he buys that, gets title to it, and he nowhere promises to do anything with it, and the theory has been that he is going to put a factory in it, tear out the machinery and use it for some commercial purpose. Now, I don't care how we get cheap fertilizer and cheap explosives. I am not interested in that. But I think any unbiased juror, passing on the evidence that we have been able to get, would come to the conclusion that the prospects of improvement lie in the Haber process and not in the cyanamid process. Now, I can not reach any other conclusion from the evidence, and I don't want to give it up, and the evidence is undisputed. The Syracuse plant is operating now. They don't make it cheap enough, probably, to make fertilizer with it.

Mr. BOWER. It is a very small plant.

The CHAIRMAN. It is a small plant, but they are putting it on the market. Our experts say if we will do the same thing, if we will spend a couple million dollars to remodel plant No. 1, we can produce fertilizer there. It is an experiment and we may lose all our money, but that is the way all developments are made, by experimentation, and I don't think we ought to give up the Haber process because of the fact that somebody got killed by an explosion. That is true of powder mills and glycerin factories and all that. A fellow was blowed up in a Ford, too, the other day, but that is no reason why he should stop making Fords.

Mr. BOWER. I believe the danger in the Haber process is always an element that has to be figured on. There is no question about that, and the chemists who know will agree that that is true, that that is an extremely delicate process, under tremendous pressures and heat, dealing with an explosive compound, and it always has an element of risk in it. I think undoubtedly that could be properly safeguarded against and I am not at all convinced that under the terms of the Ford proposal the Haber process would be abandoned, because, looking at it from a business standpoint, if Mr. Ford guarantees to make a certain amount of nitrogen and he can do it cheaper and better by the Haber process than he can by the cyanamid process, knowing the principles he has followed in his business, he undoubtedly would do it, yet at the same time, with the present Haber process record, I don't know if I were Mr. Ford, whether I would guarantee to run No. 1 plant ot not. I doubt if I would.

Senator KEYES. As I recall Mr. Mayo's testimony it was to the effect that they intended to use No. 1 plant for manufacturing purposes, making motor parts, or something of that sort; there was no intention to use it for fertilizer.

Mr. BOWER. There is a lot of machinery at No. 1 plant, as it at present stands, that is of no value for manufacturing nitrogen, that did not work, and that the General Chemical Co., who designed it, have abandoned, and in their new design have gone over to a new change, consequently it would mean the expense of remodeling that plant. I have never discussed it with any of Mr. Ford's engineers, but my thought would be if he is going to develop the Haber process he would probably do it up at No. 2, so that he would have all the fertilizer manufacture at one place, instead of having it down at No. 1, if he has got to spend around $4,000,000 to do it.

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The CHAIRMAN. When Major Burns was on the stand he explained about the explosion over there in Germany, and I think he made it perfectly plain to the committee that it was really carelessness that brought it about. If it had been handled with ordinary care it would not have happened.

Mr. BOWER. I think that is true. I don't know about the ordinary care, Major Burns.

Major BURNS. The Oppau explosion was not caused by the Haber process. It was caused by the detonation of ammonium nitrate, which is one of the products of the Haber process, and you could get exactly the same material from the cyanamid process or any other process.

Mr. BOWER. Is it not still a disputed question, but is it not thought by a great many that one of the bombs under the Haber process was what caused the detonation of the material?

Major BURNS. The explanation that is given by those who have investigated it is that the explosion was caused by a detonation of a combination of ammonium nitrate and ammonium sulphate. I don't think it is fair to charge it up to the Haber process at all.

Mr. BOWER. Of course you gentlemen in the Ordnance Department would have superior sources of intelligence about that to we outsiders.

Major BURNS. We have received quite a number of reports from various investigating committees.

Mr. BOWER. I have seen several printed reports—I don't know how scientific it would be—in which they said it was one of the bombs that let go that caused the other detonation.

Major BURNS. They were blasting with explosives in order to put it on the fertilizer market.

Mr. BOWER. Even so, the psychological effect on Mr. Ford's mind would be such that he might not want to guarantee that proposition. He knew a Haber process plant blew up, and that is what the general people of the country know, that a Haber process plant blew up.

I think, Senators, we might drop this, because really I am hypothecating a good bit as to what Mr. Ford might do and might not do, and I am getting away from our discussion.

The CHAIRMAN. Well, if your idea is correct, that he was worried about an explosion and, for that reason, did not want to guarantee the manufacture of nitrate by the Haber process, then your idea that he wanted to move it down and do it all at one plant is certainly erroneous, because the Haber process plant is 5 or 6 miles from the cyanamid process plant, and if he was afraid of its blowing up he certainly would not put them together and blow them both up instead of blowing up one of them.

Mr. BOWER. My thought was that he would not adopt the Haber process at all until he had researched its practical operation, in which case the danger of explosion would be practically eliminated, and in that case he would want it all at one plant instead of separated; but, as I say, I think this is rather hypothetical and not especially germane to the situation before us.

I want to go back to the statement that I read from Mr. Washburn's testimony about the necessity of making this next change in fertilizer development by an extraordinary or revolutionary means and not allowing a slow process of development under the present fertilizer organization. That is not so much a criticism of the present fertilizer organizations as a result that follows from an attempt to get away from what is most harmful in the present fertilizer business, and that is largely the crux of the whole proposition.

Commercial fertilizer as it is manufactured to-day and delivered to the farmer is a mixing business. The fertilizer manufacturers buy ammonium sulphate or nitrate of soda or cottonseed meal as a source of nitrogen. Some of them mine their own phosphate rock; others buy it and they buy the potash ingredients and mix those combinations to sell to the farmer.

A great handicap is the low content of the materials out of which these fertilizers are mixed. Available phosphate fertilizer contains, the best form, only 16 per cent acid phosphate, and if you want to make a commercial fertilizer, say 2–8–2 goods, you use 1,000 pounds of 16 per cent acid phosphate, and it leaves you a resultant 8 per cent phosphate content in the mixed goods. The filler, so called, is not the crux of that situation at all, but it is the low content grade of materials that are used in mixing the fertilizer.

I have that thought illustrated here in a document from the Department of Agriculture (U. S. Department of Agriculture Bulletin 798):

"A concrete example may help to make this proposition clear. If it is desired to make a mixture containing 2 per cent of ammonia, 8 per cent of phosphoric acid.

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and 2 per cent of potash (the well-known grade, 2–8–2) and the materials at hand are cottonseed meal, containing 7 per cent of ammonia, acid phosphate, containing 16 per cent of phosphoric acid, and Nebraska potash, containing 28 per cent of potash, the method of making up the mixture will be as follows: 2 per cent of a 2,000-pound ton is 40 pounds. In order to obtain 40 pounds of ammonia from 7 per cent cottonseed meal, it will be necessary to use 571 pounds of cottonseed meal. The amount of phosphoric acid desired is 8 per cent of a ton—or in fertilizer parlance, 8 units—or 160 pounds. To obtain 160 pounds from a 16 per cent acid phosphate will require 1,000 pounds of acid phosphate. The amount of potash called for is 40 pounds, and to obtain that from a 28 per cent material 143 pounds will be required. The total amount of materials used, therefore, will be 571 plus 1,000 plus 143, or 1,714 pounds. To this are added 286 pounds of filler in order to make up the ton.

"It will be seen from the foregoing statement that filler has not only a legitimate but a necessary use in the preparation of mixed fertilizer under the existing methods of manufacture. While it is likely that in the 5,000,000 tons of fertilizer produced during 1918 more than 217,000 tons of filler were used, the filler constituted only a small proportion of the inert matter in the mixture. Thus, in the example given the 2,000-pound ton contained 286 pounds of filler, while the total of inert matter was as follows: Of the 571 pounds of cottonseed meal, 531 pounds were inert; of the 1,000 pounds of acid phosphate, 840 pounds were inert; and of the 143 pounds of Nebraska potash, 103 pounds were inert, so that the total inert matter in the plant food bearing materials was 1,474 pounds, and the ton of fertilizer consisted of 240 pounds of plant food, 1,474 pounds of inert matter in the plant food bearing materials, and 286 pounds of filler.

"The fact that from three-fourths to seven-eighths of the mixed fertilizer sold to farmers consists of inert matter which does not contribute to the fertility of the soil, but on which freight must be paid and which must be ground and bagged and transported, is one of the fundamentals in the fertilizer industry. If a means were devised by which farmers could buy practically undiluted plant food and make up their own mixtures, an enormous saving would be effected, and any method that would decrease the amount of inert matter carried in fertilizers would be of great benefit to the agriculture of the country. The quantity of filler used is only a minor phase of this problem, but perhaps the part of it which is most easily susceptible of improvement while the present general methods prevail in the industry."

For instance, if you have 16 per cent of acid phosphate, the other 84 per cent of that is calcium sulphate and other impurities containing no fertilizer plant food at all, yet that has to go into this 2–8–2 mixture.

In your cottonseed meal, 7 per cent is nitrogen and there is a little percentage of acid phosphate in there and a little percentage of potash, but it is usually negligible. The balance of it is another useless material, carrying no plant food whatever, yet they have to use that as a source of nitrogen.

So these 2–8–2 and 3–8–3 goods are not the fault of the fertilizer mixers as they are to-day, but are the fault of the raw materials out of which they have to make the fertilizer and the filler, as such, which is added to bring the percentage out exactly even. Three-eight-three usually does not consist of over 300 or 400 pounds of fillers if it consists that much: often only 200 pounds of sand or humus, this actual filler that is put into it. The other useless material is the result of the low grade constituents of which the fertilizer is manufactured.

Now, there is one way to get away from that and that is at one jump to make high-grade constituents. The trouble is that you can not jump from 16 per cent acid phosphate to 20 per cent acid phosphate. The next chemical combination that gives you available acid phosphate is up around 40 per cent soluble acid phosphate. The present fertilizer association adds sulphuric acid to render phosphate rock available. In the case of the Virginia-Carolina Chemical Co. they follow that clear down the line until they themselves own sulphur mines to produce their own sulphuric acid and treat rock phosphate and make 16 per cent acid phosphate.

Now, if we are going to get 40 per cent soluble phosphoric fertilizer through the electric-furnace method, their investment in their sulphur mines and the whole thing down the line has to be scrapped out; so that the fertilizer association is never going to develop this thing as long as they can hold on to their present methods of these low-grade materials. The opposition of the fertilizer association is not based on just the belief that Mr. Ford would compete with them. It is in that research and development of these high-grade plant foods and what the electric furnace will do for fertilizer compounds that they fear which they know will force them to these high-grade materials and make them scrap this sulphuric acid treatment of fertilizer compounds. That is all an economic waste, every bit of it, if you can find a method that does away with it, because, if you take a ton of raw phosphate rock and in order to make it avail-

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able and send it to the farmer you add to that a ton of sulphuric acid, the rock contains 32 per cent P_2O_5 acid phosphate. The resultant 2 tons of fertilizer, acid phosphate fertilizer, only averages 16 per cent, because you have added a ton of sulphuric acid, and it carries absolutely no value whatever to the farmer, except that it makes the phosphate rock soluble and available for fertilizer.

Now, if you can, as has been testified before the House committee, both by Doctor Whitney, Chief of the Bureau of Soils, and by Mr. Swann, of Anniston, produce in the electric furnace phosphoric acid from phosphoric rock, and treat the phosphoric rock with phosphoric acid, you get a double super phosphate carrying from 40 to 50 per cent soluble phosphorus, and you have not added any useless material whatever, and you cut out an economically wasteful sulphuric acid proposition.

Then, if you can make phosphoric acid in the electric furnace, as Doctor Whitney says he can do and as Mr. Swann says he is doing at Anniston, and have a successful commercial fertilizer, you can absorb the ammonia from your air fixation process, but the ammonia with phosphoric acid would make ammonium phosphate. The present method is to absord the ammonia with sulphuric acid to make ammonium sulphate. Again, you have an absolute economic waste to the farmer. While, under these new methods, if you take phosphoric acid from the electric furnace production and make ammonium phosphate, you have to cut out the sulphuric acid, and you carry the ammonium to the farmer and you have used two forms of plant food in one chemical combination.

The ammonium phosphate analysis is about 20 per cent nitrogen and 40 per cent acid phosphate; so, instead of buying 2-8-2 goods and 3-8-3 goods, carrying, in one case, 12 per cent of plant food, and in the other case 14 per cent, we are carrying to the farmer a plant food which contains 60 per cent of plant food, with all the resultant saving of labor, hauling, bagging warehousing, and freight, which is a big item.

I do not want to give you the name of the gentleman who told me this, but I had a confidential conservation with one of the representatives of the big fertilizer interests, who came into the farm bureau the other day to see me with reference to the potash tariff. In discussing the question he told me that the farmers were objecting to their present prices of fertilizer. The combination of 3-8-3, he said, which we were selling at $20 before the war, and which went up to $35 and $40 during the war, was now only down to $30, and they ought to be materially lower than they were before. Now, he says, "I want to tell you frankly that $10 of that is freight on materials coming to our factories and materials going back to the farmer; that one-tfird of the price that we are asking to-day for our 3-8-3 material is freight."

And it is freight paid on sulphuric acid to make that 8 per cent acid phosphate and on similar materials. If we can cut out that uneconomic proposition through these new developments and get 60 per cent plant food, it will be a good thing. There is a lot of argument that the cyanamid process will not produce ammonia as cheaply as the by-product coke ovens. I tell you frankly, gentlemen of the committee, that if the cyanamid process will produce ammonia at Muscle Shoals at the same price per unit as the by-product coke ovens do, and this phosphoric acid can be produced as Doctor Whitney and Mr. Swann say, as cheaply per unit as the acid phosphate, and cheaper, and those two are combined and shipped to farmers, we will get our half price fertilizer, because the difference between the cost- handling, bags, storage, freight, etc.—on 3-8-3 goods and 60 per cent plant food will cut the price in half by the time it gets to the farmer, and when you realize that in addition to that——

The CHAIRMAN. Of course, you want us to give this contract to Mr. Ford. If nobody but Ford could do that I think we would have more argument on the fertilizer part of it any way. But is it confined to any individual? Could not anybody do that if it can be done at all?

Mr. BOWER. Nobody has offered to do it.

The CHAIRMAN. Why does not somebody do it as a matter of business?

Mr. BOWER. In the first place, the fertilizer industry will not offer to do it. They are fighting it.

The CHAIRMAN. Suppose the bill which is pending here, which I have introduced, was passed, and suppose this Government operation was handling this plant, could they not do it? Suppose anyone else; suppose Mr. Engstrum got it under his contract? Could he not do it? Is there any reason why Ford is the only man who can do that? He does not have any patent on that process that you are speaking of, has he?

Mr. BOWER. No. It is possible, though, that you might have to buy these processes. They are patented. I am just wondering, under the Government corporation, suppose Mr. Swann would ask you for $750,000 for his patent, would the Government ever appropriate that money to buy the patent from a single man—three quarters of a million dollars?

The CHAIRMAN. This corporation would not ask the Government to do it. They would be just as free to do it, if they wanted to, as Ford would.

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Mr. BOWER. Oh, I see. Of course, our thought is this, that in Mr. Engstrum's proposal you could possibly do these things, if it was accepted.

The CHAIRMAN. Now, let us take his proposal. Would it not be to his interest the same as to Mr. Ford's interest to do it, and would it not be to the interest of the Government corporation to do it if it could be done?

Mr. BOWER. Oh, there is no question about that. It would be to their interest to do it, surely; but when you realize that Mr. Ford's proposal is the one that comes up here and says "I will research, and if I discover it, I will use it," you will understand our proposition, because Mr. Engstrum's proposal does not say that.

The CHAIRMAN. Oh, yes: he makes a very elaborate proposal on the development plant end of it. That is one of the things in this bill, too, that this corporation shall maintain and carry on at all times the experimentation with a view to improving these mthods, just the same as Mr. Ford's proposal. I am not criticizing Mr. Ford for doing that. That is one thing in his favor, but the same thing applies to everybody excepting, perhaps, the fertilizer people who, as you say, have an interest in it.

Mr. BOWER. They have an interest in defeating this development.

The CHAIRMAN. Yes.

Mr. BOWER. There is no question about that, and they are striving very hard to do it. That does not only apply to Mr. Ford's proposal, but, as you know, last year, Mr. Chairman, they were against the proposed Government operation. They are against this whole development.

The CHAIRMAN. They are against the bill that I have introduced just the same as they are against Ford.

Mr. BOWER. There is no question about that.

The CHAIRMAN. No; there is no question about that.

Senator NORBECK. Mr. Chairman, as I understand this matter, the so-called fertilizer people have millions of dollars invested in plants that are idle because they claim to be unable to produce fertilizers cheaply enough for the farmers to buy in quantities, owing to the low prices of the farm products. Would it not be to their decided financial interest to undertake a new method by which they could produce fertilizers cheaply enough to sell at a profit, and thereby be making money instead of having their plants standing idle and losing money?

Mr. BOWER. Senator Norbeck, I think you are confusing the American Cyanamid Co., which is not classed as one of the great fertilizer manufacturing concerns, with the great fertilizer industry of this country.

Senator NORBECK. No; but the evidence here shows that there are none of the fertilizer concerns that are able to sell their output.

Mr. BOWER. Well, that is true, under the depression of crops.

Senator NORBECK. Surely.

Mr. BOWER. Due to the depression of prices on farm crops.

Senator NORBECK. And the high producing costs.

Mr. BOWER. And their costs and the farmers' lack of producing power has undoubtedly hit them very hard.

Senator NORBECK. You feel now that they would just as soon adopt another method by which they could produce this cheaper?

Mr. BOWER. Undoubtedly.

Senator NORBECK. And by which they could sell it at a profit?

Mr. BOWER. Undoubtedly.

Senator NORBECK. Well, they do not know how to make money; that is the trouble with them, is it not?

Mr. BOWER. In the first place they would have to scrap a good bit of the capital already invested.

Senator NORBECK. Well, is not that the whole history of manufacturing in this country, to scrap investments in machinery and plant and rebuild them when they can operate more cheaply and by a better process?

Mr. BOWER. Yes. The entire history has been, though, to maintain a monopoly of that kind, where they control the whole business, as far as they can possibly do so, and to tie to their present processes of manufacture. They expect that with the resumption of agricultural prosperity, which we all hope for—I will not say prosperity, but a return to the farmer's normal condition in life, that he will be able to buy their fertilizer.

Now, I have had confidential information from three sources to the effect that this very patent of superphosphate rock production has been owned and patented by one of the large fertilizer companies of Baltimore for the last five years and they have simply pigeonholed it. They have not put it in operation at all, because it would simply mean the destruction of their whole sulphuric-acid end of the business that they have. They will not do that, but they would be forced to by this development, but unless it is developed they won't do it.

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Now, it is not imagined by the farmers that at Muscle Shoals can be made all of the fertilizer you need; but if you take this step and give the farmers this kind of materials, the rest of them will have to do the same thing and come across and produce these high-grade goods, because the farmer will not stand for anything else, the farmer will not buy 2-8-2 if he ever gets hold of ammonium phosphate. There is no question about that.

Senator HEFLIN. The farmer now is paying freight on millions of tons of stuff which is useless to him?

Mr. BOWER. Absolutely so.

Senator HEFLIN. And you believe that if we place this development at Muscle Shoals in the hands of Mr. Ford, that will be eliminated very largely?

Mr. BOWER. Very largely.

Senator KEYES. Don't you think it would be eliminated by putting it in the hands of anybody who would operate that plant?

Mr. BOWER. If they would do these things, but not in the hands of the present fertilizer combination.

The CHAIRMAN. How are we going to prohibit these fertilizer people from buying Mr. Ford's corporation after he dies? They would eliminate it then and add it to the combination.

Mr. BOWER. Well, Mr. Chairman, that is along the line of the discussion that took place yesterday, and I can not see anything, except regulation when the crisis arises as the solution to that problem. I know one thing, and that is that this board of farmers, sitting in and going over the books of that concern, as far as the fertilizer side of it is concerned, will prevent their getting away with anything or putting anything over on agriculture.

The CHAIRMAN. All right. Let us take that up. I did not like to interrupt you because you said you were going to discuss it later, that paragraph 16.

Mr. BOWER. Paragraph 16, I believe.

The CHAIRMAN. You have seen men elected to the Senate and House and to other official positions on one platform and you have heard them say what great things they were going to do for the people after election; you have seen them go back on them, have you not? You no doubt could call to mind and mention by name a great many instances of that kind in your brief experience with legislators. You have often seen corporations and companies organized to carry out philanthropic purposes, and you have seen special interests get control of them, and do absolutely the opposite to what they had intended to do, and yet you have mentioned by name an organization of farmers of whom you are one of the representatives at the present time, that shall be an instrumentality in the selecting of the members of this board a hundred years from now. Can you give any assurance that the Farm Bureau that you now represent will not next year, even, be absolutely controlled and dominated by the Fertilizer Trust, or the representatives of that organization? I am not making any such charge.

Mr. BOWER. Oh, I appreciate that.

The CHAIRMAN. But the charge has already been made on the floor of the Senate that your organization now is to some extent under the domination of the fellows that control the railroads.

Mr. BOWER. Well, we simply point to our records, as far as that is concerned.

The CHAIRMAN. Yes; but these farmers' organizations that are mentioned in there very likely will not be in existence 50 years from now.

Mr. BOWER. No; but their successors will. The organization of the agricultural business is here to stay.

The CHAIRMAN. Yes; I think so; but the danger is that these very special interests that you are referring to will control your own organization, and it would be to their interest to do it if, by doing it, they could control that board.

Mr. BOWER. At the same time they would have to control the President of the United States, who makes the nominations, and the United States Senate which confirms them.

The CHAIRMAN. And that would be a good bit easier, probably, than to control your board.

Mr. BOWER. Well, if you get a combination that can control all three representatives of the people, we could not get any fertilizer from anybody anywhere.

The CHAIRMAN. You have seen Presidents of the United States controlled very easily; the people were asleep while they were getting hold of them. Now, have you ever followed a convention of the Republican Party or the Democratic Party and observed how very little the rank and file, the real people, have to say about who the nominee will be, and that will occur again when the next convention takes place? You have seen it with the Senate, have you not?

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Mr. BOWER. Mr. Chairman, I would like to ask you what you would suggest instead of that. If they get control of the United States Senate and control of the President of the United States, they are going to get control of your corporation.

The CHAIRMAN. Probably, but my corporation is going to live a good deal longer than yours without a change. Now, it may change. I realize, Mr. Bower, that there is not any way under the heavens to fix it so that it can not be controlled. You mentioned the Federal Trade Commission in there. I have not as much faith in the Federal Trade Commission as you have, and I have always been one of its defenders, but I realize that in 10 years from now the Federal Trade Commission may be dominated by this corporation that you are scared to death about right now. We can not get away from it; it is an impossible thing. We hope those things will not happen, but they are liable to happen with any of us. That is the only reason why I do not want to enter into a deal that will run for a hundred years and block the people's rights.

Mr. BOWER. The paragraph dealing with the creation of this board was referred to the executive committee of the Farm Bureau Federation in session here in Washington at the time it was written, and the executive committee approved that method. We believe that if the farmers themselves sat in by invitation, with the right to go over the books and the right to appeal to the Federal Trade Commission for relief they would get relief, if there was any improper thing done.

The CHAIRMAN. As at present constituted, I think they would do it.

Mr. BOWER. As at present constituted; yes.

The CHAIRMAN. Now you can assume that the Federal Trade Commission will be a permanent body, but you can not assume that this organization is going to be permanent.

Mr. BOWER. If these interests got all of that control they would probably do away with the Federal Trade Commission.

The CHAIRMAN. If, instead of mentioning your organization or some other organization, you had left it in a general way to organizations representing the rank and file of the farmers of the country, or something of that kind, it would be a whole lot better, and if your organization represented them, well and good; and if they did not, they ought to be out, as they ought to be.

Mr. BOWER. I would like to have Mr. Silver discuss that phase of the matter.

Mr. SILVER. If you do not mind, Mr. Chairman, could we finish this direct examination?

The CHAIRMAN. Oh, yes.

Mr. SILVER. We would be glad to say something about that after we put this in in sequence and connectedly.

The CHAIRMAN. All right.

Mr. BOWER. With reference to nitrogen production, I simply want to say that, in spite of the representations that are being made in opposition to this development as a whole, there is no industry in America primarily engaged in nitrogen production. I say "primarily engaged in nitrogen production." The by-product coke ovens are the largest domestic producers of nitrogen compounds and their nitrogen is only one of numerous by-products. Their major industry, of course, is the production of coke. Mr. McDowell, president of the National Fertilizer Association, testifying before the House about the prices of the by-product coke ovens, says that they make ammonia for $1.50 a ton. I am surprised that those figures are so low. Nevertheless I think it is quite certain that before the by-product ovens would abandon the production of ammonium compounds for fertilizer usage, the price would have to be materially lowered over what it is being sold for to-day. Of course, there is a certain fixed cost in the actual production of this ammonia that they would have to meet.

It must be remembered also, in figuring on the capacity of the ammonium sulphate ovens, that they give their capacity in terms of ammonium sulphate. For instance, they say that in 1920 their capacity was 467,000 tons of sulphate equivalent. That does not mean a production of 467,000 tons of ammonium sulphate. In 1920 the actual sulphate production was 337,500 tons. The balance was ammonia, ammonia liquor, anhydrous ammonia, and ammonia for household purposes. The ammonia liquor and the anhydrous ammonia are the first market they supply before they make ammonium sulphate. I do not mean the first in point of time, but the first in point of economy of operation. That is, they produce ammonia in the form of gas. Of course, that is not commercial. The simplest way to make it in commercial form is to absorb it in water, and when it is in that form it goes out for refrigeration and household purposes. Whatever the demand is for ammonia in that form it is supplied economically first, so that what we get is a by-product with a preferential first market from the by-product coke ovens, and we get what is left, and, as I showed at the beginning of our testimony, our demands for nitrogen far exceed the actual production

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of ammonium sulphate, which in 1920 was 337,500 tons. The nitrogen required for just corn, wheat, and oats alone for one year would take over 9,000,000 tons of ammonium sulphate to supply it. Those figures that I am giving you are taken from the United States Geological Survey reports.

Senator NORBECK. The 9,000,000 tons would be the entire consumption, would it, or would you put something additional into the soil?

Mr. BOWER. No; it is this, Senator Norbeck: That is the amount of nitrogen contained in the grain alone of those three crops in one year. That is, corn, wheat, and oats, in the grain alone. I figure, though it is not true, that in that case the straw and roughage went back into the land, but there is a waste and loss in handling the manures and refuse.

Senator NORBECK. Would that mean, then, that it would take 10,000,000 tons a year to really keep the soil replenished?

Mr. BOWER. Yes; for those three crops alone, easily. Do not get the idea that there is no action in the soil that is recovering nitrogen bacterially and through legumes and other methods. Take this Leonardtown soil all through this country here. You know how absolutely exhausted it is. There is no farming here at all, and yet right down here at Mount Vernon Washington had a flour mill on his own estate, and he exported flour to England that he raised right on that farm. A chemical analysis of that soil to-day simply shows a trace of nitrogen. It is gone. It has been wiped out by 300 years of cultivation without being replaced. It is gone.

Senator HEFLIN. Do you say it would take 10,000,000 tons to answer the needs of the grain crop alone?

Mr. BOWER. Of corn, wheat, and oats alone, in the grain. In the grain it is 9,912,000 tons of ammonium sulphate. You will find it in the first part of the hearings.

Senator HEFLIN. We now make only about 8,000,000 tons of it, I believe.

Mr. BOWER. That is gross fertilizer?

Senator HEFLIN. Yes.

Mr. BOWER. That is commercial fertilizer.

Senator HEFLIN. Yes.

Mr. BOWER. This is ammonium sulphate alone which carries around 25 per cent of ammonia, while 8,000,000 tons of fertilizer would not average over 3 per cent, I believe; surely not over 3 per cent. So you see your 8,000,000 tons is wholly inadequate. If you were going to put that nitrogen in bulk 3-8-3 fertilizer you would have to multiply it over 10 times, or 80,000,000 tons.

Senator HEFLIN. How many tons of fertilizer do you believe that we could use profitably in the United States, cotton, grain, and all?

Mr. BOWER. I could not answer that question, Senator Heflin, and would not attempt to. In the first place, the word "fertilizer" is a very indefinite word. It may mean 2-8-2, 3-8-3, 4-10-4——

Senator HEFLIN. Commercial fertilizer.

Mr. BOWER. It may mean any one of a hundred different combinations of fertilizer compounds. It may mean nitrate of soda itself.

Senator HEFLIN. Doctor Whitney stated the other day that he thought we could easily use twice as much as we are now using

Mr. BOWER. Senator Heflin, when the price is cut twice as much will not begin to supply the demand.

Senator HEFLIN. The need is really greater than that amount?

Mr. BOWER. Oh, undoubtedly, and the commercial utilization of it would be greater than that. For instance, careful research in Germany demonstrated that 1 pound of nitrogen applied to the soil increased the yield of wheat one-third of a bushel. Now, that is a not very good general statement to apply everywhere, but under their conditions they found that 1 pound of nitrogen added to their soil increased the yield of wheat one-third of a bushel.

The CHAIRMAN. Fifteen pounds?

Mr. BOWER. No, sir; 20 pounds.

The CHAIRMAN. Yes; 20 pounds.

Mr. BOWER. Now, 1 pound of nitrogen in commercial fertilizer costs the farmer to-day about 30 cents a pound, so you would have to be securing over $1 a bushel for wheat before you were sure you were going to get any economic return on the labor and freight and hauling, and the application of that 1 pound of nitrogen under the wheat at 30 cents a pound.

The CHAIRMAN. Oh, yes; and you would have to be sure that you did not have a hailstorm and did not have a drought.

Mr. BOWER. Exactly so.

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The CHAIRMAN. And you did not have the rust or anything else.

Mr. BOWER. Exactly so. But if you could get it for 5 cents or 10 cents a pound, you would use it under the wheat, because you would take that risk, and your increased return would pay a return on the investment. Fertilizer is of no value to the farmer unless it increases the crop over what the crop would be without fertilizer enough to pay for the fertilizer, the labor of applying it, and give him a profit. It has got to do that or the farmer will not use it. He will stop right there.

Now, the reason we have to use it on our eastern soils is that if we do not put fertilizer on at all we would have no crop; so that the addition of an application of 200 or 300 pounds of commercial fertilizer makes a crop, and without it we get nowhere.

Senator HEFLIN. If you could eliminate that useless material that the farmer is now paying for, his profit on his crop would be greater, would it not?

Mr. BOWER. The elimination of all the useless material would mean an increase of the percentage of plant food in the fertilizer and a lower cost. As I say, you can not do that just slowly. You have got to do it at one jump. You have to jump the creek and get into these high fertilizer compounds at one jump.

Senator HEFLIN. Thereby reducing to the farmer the cost of production?

Mr. BOWER. Absolutely so. That would naturally follow. We have had a great deal of discussion about whether Mr. Ford can make this half-priced fertilizer. We see it coming, and under the cyanamid process, if you make ammonium phosphate, because if we buy a ton of ammonium phosphate from that plant, carrying 20 per cent of ammonia and 40 per cent of acid phosphate, we would not have to pay freight, hauling, bagging, dealer's profit, and all of those other things on over 5 tons of the present commercial fertilizer.

I had a discussion with a representative of the fertilizer interests, and he was the vice president of one of the largest fertilizer companies in the United States, and he said that to-day out of $30 per ton of 3–8–3 $10 is freight, and you can see from that where we expect to get our half-price fertilizer.

Cottonseed meal is another large source of nitrogen fertilizer in this country, and that is an economic waste—that it should be put on the ground. It is more valuable as feed for cattle and feed for sheep than it is as fertilizer, and especially is that true when you realize that when it is fed to cattle the return in the manure is 75 per cent of the actual fertilizer elements that were in the cottonseed meal to start with. Only 25 per cent is digested and retained by the cattle when it is fed to them, so that to put cottonseed meal into the farm without passing it through live stock is an economic crime. Some farmers still insist upon it; some of it still has to be used because of the inadequacy of the supply. Some farmers have used it for years, and they still want cottonseed fertilizer, but if you take your fertilizer compounds and put them down here at a cheaper price, it will switch to the live-stock industry, where it belongs, economically and efficiently.

Senator KENDRICK. Have you any figures to show what proportion of the cottonseed meal produced is used for fertilizer and what proportion of it is used for feed?

Mr. BOWER. Yes. I have not those figures with me, but I will insert them in the record. I have that material at the office.

Senator KENDRICK. Very well.

In the aggregate, two-thirds of the cottonseed meal was used as feed and one-third as fertilizer.

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TABLE VIII.—*Production and disposal of cottonseed meal and cake, by States, July 1, 1917, to June 30, 1919.*

AMOUNTS IN 2,000-POUND TONS.

State.	Number of mills reporting.	Total tons of cottonseed meal and cake produced.	Quantity used by mills in the manufacture of fertilizer.	Quantity sold to farmers to be used as—		Quantity shipped to other points to be used as—		Undistributed.
				Feed.	Fertilizer.	Feed.	Fertilizer.	
Total for 16 States	506	1,616,617	62,656	186,952	200,905	756,581	243,625	165,896
Alabama	41	78,352	4,738	8,107	6,210	26,645	12,424	20,228
Arizona	3	6,597		2,406		4,191		
Arkansas	32	137,633	3,226	14,510	3,305	101,690	8,614	3,288
California	1	7,327				7,327		
Florida	3	6,692		160	440	4,025	2,067	
Georgia	107	346,603	23,691	29,879	52,781	114,786	71,638	53,828
Illinois	1	3,781		300		3,481		
Kentucky	1	5,173		1,000		3,773	400	
Louisiana	25	140,434	427	9,490	8,224	80,671	41,622	
Mississippi	48	214,715	6,917	16,718	9,210	140,023	18,841	23,006
Missouri	3	20,130		1,080		19,050		
North Carolina	57	129,466	13,019	13,024	42,251	11,985	40,683	8,474
Oklahoma	48	141,282	1,098	43,910	2,080	91,194		
South Carolina	75	161,801	9,409	21,748	71,230	15,565	43,852	
Tennessee	20	105,368		2,510	4,378	62,199	3,484	32,676
Texas	41	111,260	101	22,080	796	63,976		24,307

PERCENTAGES.

State.	Used by mills in the manufacture of fertilizer.	Sold to farmers to be used as—		Shipped to other points to be used as—		Total percentage used as—	
		Feed.	Fertilizer.	Feed.	Fertilizer.	Feed.	Fertilizer.
Total for 16 States	4.3	12.9	13.8	52.2	16.8	65.1	34.9
Alabama	8.2	13.9	10.7	45.8	21.4	59.7	40.3
Arizona		36.5		63.5		100.0	
Arkansas	2.4	10.3	2.5	77.9	6.4	88.7	11.3
California				100.0		100.0	
Florida		2.4	6.6	60.1	30.9	62.5	37.5
Georgia	8.1	10.2	18.0	39.2	24.5	49.4	50.6
Illinois		7.9		92.1		100.0	
Kentucky		19.3		73.0	7.7	92.3	7.7
Louisiana	.3	6.8	5.9	57.4	29.6	64.2	35.8
Mississippi	3.6	8.7	4.8	73.1	9.8	81.8	18.2
Missouri		5.4		94.6		100.0	
North Carolina	10.8	10.8	34.9	9.9	33.6	20.7	79.3
Oklahoma	.8	31.0	1.5	66.7		97.7	2.3
South Carolina	5.8	13.5	44.0	9.6	27.1	23.1	76.9
Tennessee		3.5	6.0	85.7	4.8	89.2	10.8
Texas	.1	25.4	.9	73.6		99.0	1.0

Mr. BOWER. Cottonseed meal, again, is a by-product of the cottonseed-oil industry, so that this is not a nitrogen produced in America as a primary industry.

It is interesting to see how the fertilizer interests and these cottonseed meal interests are all tied up. The Southern Cotton Oil Co. is the largest cottonseed meal producer in the South, and it is owned outright by the Virginia-Carolina Chemical Co. James B. Duke is the principal stockholder in the Virginia-Carolina Chemical Co., and he owns 23 to 24 per cent of the American Cyanamid Co. The Virginia-Carolina Chemical Co. owns 26 per cent of the stock of the American Cyanamid Co. It is interesting to note that Mr. Duke's interest of 23 to 24 per cent and the Virginia-Carolina Chemical Co.'s interest

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in this American Cyanamid Co. figure out just 50 per cent. We believe that if the testimony were given correctly, it would probably figure 51 per cent. Mr. Duke's stockholders were given as 23 to 24 per cent, and the Virginia-Carolina Chemical Co.'s interest as 26 per cent. I believe Mr. Duke's interest is probably around 25 per cent and that of the Virginia-Carolina Chemical Co. 26 per cent.

The CHAIRMAN. Well, they could get control of the corporation, anyway, if they had 50 per cent.

Mr. BOWER. Surely.

The CHAIRMAN. Fifty per cent of the stock is more than necessary to control it unless it is a very close corporation.

Mr. BOWER. I have not read the testimony of Mr. Hammitt, representing the Air Nitrates Corporation and the American Cyanamid Co. before this committee, but when he was before the House Military Affairs Committee he condemned this Ford proposal as a subsidy, and when questioned he said that subsidy consisted in this 4 per cent money for the development of Muscle Shoals power. Well, Senator Norris and Senator Kendrick and Senator Heflin will remember when Frank Washburn, the president of the American Cyanamid Co., was here in 1916 before this very committee, and before that House Military Affairs Committee he advocated this very identical kind of a proposition—the development of Muscle Shoals and the building of a nitrogen fixation industry there, and that the Government should be connected with it and would have to be, and that the Government's part would consist in furnishing money at 3 per cent to complete the dam at Muscle Shoals.

The CHAIRMAN. At that time Mr. Washburn was talking against a governmental corporation like that which I have introduced in my bill?

Mr. BOWER. Surely.

The CHAIRMAN. And now he is talking against the Ford proposition?

Mr. BOWER. Surely; he is talking against the Ford proposition here; that is true; but they now condemn the subsidy of 4 per cent, which they asked for themselves in 1916 at 3 per cent. It was not a subsidy then but was a proper governmental cooperation, as they testified.

Now, coming to Chile, I do not think there is any necessity——

The CHAIRMAN. I have no doubt but what if any of these people had the Ford proposition they would not consider it a subsidy.

Mr. BOWER. I do not think there is any question about that at all.

The CHAIRMAN. And of course according to Fords representatives now it is not a subsidy, but if the same thing were tendered to the Fertilizer Trust you would think it was a subsidy and you would not want it done. The difference between you and me is that I think it is a subsidy no matter who has it, and I do not want anybody to have it.

Mr. BOWER. The Fertilizer Trust would never put section 16 into this proposal.

The CHAIRMAN. I do not believe that they would hesitate for a minute on section 16. I may be entirely wrong about it, but I think section 16 is just a lot of camouflage; it will not amount to anything as a practical proposition. That is not the weakness in it, nor the strength, either.

Mr. BOWER. We have discussed Chile. That is our only other competitor—foreign competitor at present—though we expect possibly, if we do not run our own plant, we will get some from Germany soon; at least the by-product coke ovens are fearful that we will. Chile is the great source of nitrate supply for this country and dominates the price fixing of the supply of nitrogen.

The CHAIRMAN. Before you leave that other point that you were making about Washburn and Hammitt and their company, the American Cyanamid Co., considering it a subsidy now, when offered to Ford, when they were here before advocating, as you say, that they should have it, and it was not a subsidy at that time, you were opposing them, were you not?

Mr. BOWER. We had advocated the Muscle Shoals development. We had had no connection with them and we were not advocating their proposal.

The CHAIRMAN. Is it not true that at that time there was a bill providing for a governmental corporation and the organization of it, and you were supporting that bill at that time, were you not?

Mr. BOWER. No; there was no such bill at that time.

The CHAIRMAN. But did you not support that Government bill?

Mr. BOWER. Yes, sir.

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The CHAIRMAN. Or your organization did.

Mr. BOWER. In the testimony here last year; yes, sir. We appeared before this committee last year, asking for that S. 3390.

The CHAIRMAN. But you are opposed to it now?

Mr. BOWER. Well, we did not have the Ford proposal.

The CHAIRMAN. No; that is true.

Mr. BOWER. And Government operation——

The CHAIRMAN. You had a right to do that; I am not criticizing you at all.

Mr. BOWER. Government operation was the only thing offered to us. The farmers united, I think, in a joint appeal—the grange, the farmers' union, and the farm bureau—to the House of Representatives, asking for a hearing; I know they did, the representatives of every one of those organizations, and the national board, the National Grange, the farmers' union, and the farm bureau signed a joint appeal that went to every member of the House of Representatives asking for a hearing on this 3390.

The CHAIRMAN. That was a Government operation bill?

Mr. BOWER. That was a Government operation bill.

The CHAIRMAN. You were all in favor of it?

Mr. BOWER. We could not get a hearing before the House, and this proposition is before the same committee of the House to-day that refused to grant us a hearing even last year.

The CHAIRMAN. Please answer my question. All of these various interests were in favor of it, then?

Mr. BOWER. Yes, sir.

The CHAIRMAN. The Senate passed the bill, did it not?

Mr. BOWER. Well, the farmers would have gotten mighty little out of S. 3390, as it passed the Senate. As it passed the Senate it was not a farmer's bill.

The CHAIRMAN. I agree with you, and I think it should have been amended, and I tried to do that in this bill. Don't you think that this bill is a vast improvement over that?

Mr. BOWER. Well, S. 3390, as introduced, was not just the bill as it was passed by the Senate.

The CHAIRMAN. That is what I mean.

Mr. BOWER. That is where the interests came in and blocked everything that we tried to put in that bill.

The CHAIRMAN. What difference does it make——

Mr. BOWER. I never could quite understand the friends of that bill—who took credit for the passage of it in the Senate—because of the form in which it passed the Senate as there was very little left in it for the farmer.

Senator HEFLIN. But it could not be passed in any other way. We had hoped that in the conference with the House it would be amended.

The CHAIRMAN. Well, sometime before you get through, Mr. Bower, I wish you would take up this bill which is pending before this committee and discuss it and give out your ideas about it.

Mr. BOWER. The thing we see, is just the impossibility of getting it passed.

The CHAIRMAN. Oh, yes; that may be.

Senator HEFLIN. Just give him your frank opinion about it—that is what he wants.

Mr. BOWER. My opinion is this: With the interests that are opposed to the fertilizer developments at Muscle Shoals by Government operation, by Ford, or by anybody else, if you add and superimpose upon that the general opposition by the great body of the Members of the Senate and House to Government operation in any form, you have defeated the bill before you have started to advocate it.

The CHAIRMAN. Don't you think that in this bill that is introduced here the corporation that is set up is completely and entirely removed from any of the evils that are always alleged against Government operation of anything?

Mr. BOWER. We thought S. 3390 also was.

The CHAIRMAN. Well, I did not think so. I thought there were lots of loopholes in that myself, and if I had not been sick at the time I would have introduced a substitute, something like I have done here, at that time.

Mr. BOWER. I do not think it is a question of the form that Government operation takes. It is the conscientious objection of men who are actual friends of the farmers who are opposed to Government operation under any condition.

The CHAIRMAN. That is what this bill is intended to do, to meet those objections. I introduced the same kind of a bill to control the railroads, and I

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remember distinctly several men who were bitterly opposed to Government operation, after they had examined into it were very much in favor of it. Now, when you speak of Government operation of a plant ordinarily, without looking into the form of it, lots of people are opposed to this who would favor it if they looked into it and saw that htere was organized there a corporation that would be just as free from the evils, such as partisanship, as a private corporation would be, and I think more so, because the special interests that might get behind a private corporation with sinister motives would not have an opportunity to get behind this corporation. But it is a tentative plan, and now from you, who are representing a large farmers' organization, I would like to have it criticized or condemned, if you think it should be condemned. If there is any way to improve it, let us find that out. I would like to have some constructive criticisms, if there are any, that can make it into a good bill. In other words, I want it to get through the crucial test.

Mr. SILVER. Senator, if we may complete this testimony——

The CHAIRMAN. I say, I do not want you to do it now, unless you want to do it. Do it whenever you want to.

Mr. SILVER. We will be very glad to take your bill up and make a detailed report on it.

The CHAIRMAN. All right.

Senator HEFLIN. Now, Mr. Bower, Senator Norris asked you about supporting other bills, and you stated that you could not even get a hearing on that bill. Of course, that proposition had to be abandoned, and you could not get any bill then. Then when Henry Ford's offer was made you thought and you still think that your only hope to get relief from the Fertilizer Trust and to get an additional supply of fertilizer is through this Ford offer; is not that the case?

Mr. BOWER. That is my belief, absolutely. The farmers' union has indorsed the Ford proposal by a resolution at the last annual convention. The farm bureau indorsed the Ford proposal at their convention, and also reserved the right, if that proposal is rejected, to insist upon a Government-owned corporation. We do not intend to lose the opportunity to Muscle Shoals if we can help it; but we see in the Ford proposal a solution, through private industry, of the difficulties that we met with in that development.

The CHAIRMAN. Is not that mainly because this is Ford and not because of what is contained in it?

Mr. BOWER. So far as the commercial proposition is concerned, no, Senator. There will be a safeguarding of fertilizer production through this board. Of course, Mr. Ford may have a stroke of apoplexy and die to-morrow, but we figure that this thing gets started; this board of farmers is appointed; a certain program and a certain definite plan of operation are inaugurated; and the farmers will be cooperating with Mr. Ford not only to reduce the cost of production but the cost of distribution. Under this contract the farmer has a right to go over the heads of these middlemen that have been between us and the fertilizer in the past to the source of the manufacture of these ingredients, through our cooperative organizations.

Now, the board will be selected, appointed, and confirmed by the Senate, and we will sit in with Mr. Ford and start this plan. If Mr. Ford dies and this corporation, as you said, may get into the control of some antagonistic group, the moment they change the procedure and method at that fertilizer plant which was started by Mr. Ford you would have an appeal from that farmers' board to the Federal Trade Commission, and there will be an appeal from the farmers of the country to Congress on it.

The CHAIRMAN. All right; then they would have to get back to some Government corporation similar to the one I have set up here now. That is what they will be up against. I think that is probably just what would happen.

Mr. BOWER. Or a ruling issued permitting the company to do certain things or there would be a cancellation of the contract.

The CHAIRMAN. I think if you are fair you will have to admit that if this corporation to whom you are going to deed some of this property and lease the balance of it would come under the control, through the sale of stock or in any other way, of interests that were opposed to the proper development and the manufacture of cheap fertilizer, it would be a failure? It would be a failure if that happened, would it not?

Mr. BOWER. I do not think there is any question about that. I agree with you on that.

The CHAIRMAN. That is the Ford proposition.

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Mr. BOWER. I think you have protection there against that in your board and the provisions for that board. Now, I am not a lawyer, but under that contract that board is provided for, and it starts out in order that the farmer may secure cheaper fertilizer, etc.; and I believe the authorities would determine the action under that proviso with reference to the board's powers.

The CHAIRMAN. Well, as I look at it, if that board were operating under an unfriendly corporation, the board would be as powerless as you would be to defend themselves against a stroke of lightning in a thunderstorm.

Mr. BOWER. There is one thing about the present fertilizer combinations and mixtures that are furnished the farmer to-day that I would like to call your attention to. For instance, take 2–8–2 and 3–8–3. Neither of those combinations are a balanced ration for the plant or a balanced fertilizer for the plant. They were so designated by Mr. McDowell in speaking before the House Military Affairs Committee—that these combinations were what the farmers were using and they were balanced. They are balanced on the basis of the cost of materials but not on the basis of the plant's requirements. That is the trouble with them.

For instance, take the food requirements of wheat, corn, oats, alfalfa, and clover. Thirty bushels of wheat require 35 pounds of nitrogen, 15 pounds of acid phosphate, and 9 pounds of K_2O; corn, 75 bushels, 68 pounds of nitrogen, 29 pounds of acid phosphate, and 16 pounds of potash; oats, 60 bushels, 40 pounds of nitrogen, 16 pounds of acid phosphate, and 11 pounds of potash; alfalfa, taking some of its nitrogen from the soil and some from the air through its bacterial action, 4 tons, 190 pounds of nitrogen, 43 pounds of acid phosphate, and 178 pounds of potash; clover, 2½ tons, 103 pounds of nitrogen, 20 pounds of acid phosphate, and 82 pounds of potash.

So you see, in all of these typical crops the nitrogen requirements of the plant overbalance the acid-phosphate requirements of the plant to grow, and yet in our commercial fertilizer the acid-phosphate elements overbalance our nitrogen elements, and it is simply that they can put in 8 pounds of acid phosphate, under the present prices per unit of plant food, where they can only put in 100 pounds 2 pounds of nitrogen and sell it to the farmer, because 2 pounds of nitrogen costs them about 15 cents a pound, or about 30 cents to put it in there. Eight pounds of acid phosphate only costs them about 4 cents a pound. So that they do not balance these fertilizer combinations on the basis of plant food requirements, but on a combination that they can sell to the farmer.

The CHAIRMAN. Whenever you get to a good stopping place, we will take a recess, Mr. Bower.

Mr. BOWER. I will be finished in a few minutes, Senator, unless there are some further questions.

The CHAIRMAN. All right.

Mr. BOWER. We, as I say, have reached the conclusion that the Ford proposal and his method of manufacture of the fertilizers and his method of distribution as proposed in his contract, together with the guaranteeing of 110,000 tons of ammonium nitrate per annum, which does not mean ammonium nitrate, but which means 40,000 tons of ammonia in commercial fertilizer combinations, is the best offer that is presented to the farmer to-day that we have any hope of securing, and we fear that every delay will simply strengthen the opposition. We think the interest in the Muscle Shoals development will pass, and we will lose out completely, and it will get into the hands of the private interests that have been trying to get it into their hands all the time.

So, as I say, the Farm Bureau asks the acceptance of the Ford proposals.

The CHAIRMAN. Are there any other questions that any of the members of the committee wish to ask Mr. Bower?

Senator HEFLIN. I just want to say, Mr. Chairman, that Mr. Bower states that his organization of farmers indorses the Ford offer.

Now, Mr. Bower, do you feel that if Mr. Ford gets this Muscle Shoals property he will use it to the benefit of more people than it would be if operated under the control of anybody else? Do you feel that way about it?

Mr. BOWER. Anybody else who has made any proposal for it.

Senator HEFLIN. Yes; but don't you feel that the Ford offer is the only one of the offers that holds out to the farmers of the country any prospects for cheaper fertilizers?

Mr. BOWER. Absolutely.

Senator KENDRICK. Would it suit you as well, Mr. Bower, to have the plant continued in operation by the Government, plant No. 2, if the Government com-

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pleted the dam and retained control of it, and then proceeded to operate plant No. 2 to something like full capacity in the manufacture of nitrates? Would it not suit the farmers equally as well as if it were in the hands of the captains of industry or in the hands of the commercial interests?

Mr. BOWER. Well, take this situation, Senator Kendrick: For this phosphorus production that I spoke about you have no plant down there. As to the successful demonstration, such as Mr. Swann could give the committee, I believe if you would have him come here, as he did before the House committee, or as Doctor Whitney would testify to, that the phosphoric acid production in the electric furnace would be successful and would be cheaper and would make these high compounds, 40 or 50 or 60 per cent, would require a phosphoric acid reduction plant at Muscle Shoals. Then you would have a real opposition to the Government making any such investment.

In your nitrogen fixation, as I stated, you have no primary industry in this country engaged in producing nitrogen, but you have capital invested all over the country in the production of acid phosphate and in sulphuric acid methods of producing this. If Mr. Ford found that should be advisable, he himself would make the investment in the phosphoric acid plant.

Senator KENDRICK. Yes; my idea is, though——

Mr. BOWER. The difficulty is the securing of the necessary additional appropriations. The Muscle Shoals horsepower development requires $50,000,000, according to the engineers, and if you are going into the different branches of the Tennessee River and equalize that power probably $15,000,000 to $20,000,000 on top of that, and then your Haber process and your own testimony is $3,000,000 on that. As to the cyanamid plant, a good many people say it will not work, but I believe it will, but I do not know about your phosphoric end of it. I do not know what it will cost.

Senator KENDRICK. But I understand that even with Ford's proposition the Government is to finish Dam No. 3.

Mr. BOWER. Under the proposal that Mr. Silver explained yesterday there would be an issue of bonds by the Government to carry that out, in which case Mr. Ford would pay interest on the bonds and retire the bonds by his amortization fund, so that it would require no appropriation from the Treasury.

Senator KENDRICK. Yes. Well, it has occurred to me in connection with the manufacture of these different products, the country seems to be very well supplied with every kind of product that enters into the manufacture of fertilizer, except nitrogen. You have stated that a number of different companies are producing different kinds of fertilizer, but it occurs to me that, even through Government operation or in any other way, that if we supplied this one commodity needful the natural laws of trade and business would take care of the others.

Mr. BOWER. Well, you would have this difficulty, that a great deal of the farmer's fertilizer—not all, but a large proportion of it—is a mixed combination of nitrogen and phosphorus compounds, and under your suggestion the nitrogen would have to go to the mixers, and on up through, and that is one of the things we were fearful about last year.

Senator KENDRICK. Is it not reasonable to suppose that if the Government were operating this plant they would be as diligent about accepting or adopting any improved methods of manufacture as individuals or corporations would?

Mr. BOWER. You may assume that.

Senator HEFLIN. But these fertilizer people who are now fighting the Ford offer would fight it just as hard if it came from the Government?

Mr. BOWER. Any time there would be a development of a new process we would have to have the same fight about giving an appropriation, unless the corporation was earning enough to make the investment itself, and in the case of the phosphoric-acid plant we would probably have a bitterer fight, because we would have a more actual American industry that this would compete with.

The CHAIRMAN. Is that all you have now?

Mr. BOWER. That is all, if there are no further questions, Mr. Chairman.

Senator HEFLIN. The people you represent are anxious to have this matter acted upon as early as possible, are they not?

Mr. BOWER. You do not know how vitally interested we are in that because in a delay we see the failure of the whole proposition. The opposition is growing and strengthening, instead of the influence of the proponents growing, I am afraid.

The CHAIRMAN. I am afraid you are mistaken about that. We were defeated before. There was a committee of the House that went down there

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and investigated it, and they reported back, as I understand it, that they wanted to let the Government scrap everything, let everything go and lose all the money that was put into it. Now, since it has started up, I think it has convinced everybody that has been connected with it that no matter what we may decide as to what shall ultimately be done with it, we must go on and finish that dam.

Mr. BOWER. Why, Senator, you could get an appropriation to finish that water power, if you divorced the operation of that fertilizer plant from it, in 20 minutes in the House and Senate both, if the people that voted for it knew that the fertilizer plant was not going to run. The whole crux of the thing is in that fertilizer plant. These power companies would come in at any time and advocate the building of that power dam.

The CHAIRMAN. If that is true, then you ought to unite on getting that appropriation and start on the work right away.

Mr. BOWER. But, Senator, any farm organization can not advocate that appropriation, unless tied into it is the legislation that requires the operation of that plant.

The CHAIRMAN. Now, Mr. Bower, you are the first one that I know of——

Mr. BOWER. I am giving you my personal opinion, and what I would recommend to the farmers. I do not know that Mr. Silver would agree to it at all.

The CHAIRMAN. I do not think you would say that if you weighed your words, because, no matter what we want to do, it is a physical impossibility to get any plan through here outside of a direct appropriation to continue the work any time within the immediate future—no matter what we want to do. Let us not deceive ourselves; we do not get anywhere by making ourselves believe something that we know is not true.

Senator HEFLIN. One of the obstacles, according to Mr. Bower, is this, that these other concerns who are now fighting the Ford offer would be willing to have the dam completed if you divorced it from any idea of making fertilizer.

The CHAIRMAN. Oh, yes.

Senator HEFLIN. And if it could be completed without the understanding that it would be used for making fertilizers, then they would use their influence in keeping it for their own use, according to Mr. Bower's statement.

The CHAIRMAN. No; his language is plain. He said he was opposed to any appropriation for carrying on any of this work——

Mr. BOWER. No; to complete it.

The CHAIRMAN. Unless coupled with it——

Mr. BOWER. To complete it.

The CHAIRMAN. Oh!

Mr. BOWER. I am not referring to that other proposition, but I say if it was completed by appropriation from the United States Treasury without legislation for the operation of the nitrate plant they never will get the operation of the nitrate plant.

The CHAIRMAN. Let us see that we do not misconceive what you said in the record here, so that it will not be used against this appropriation. This committee has directed me——

Mr. BOWER. I appreciate that.

The CHAIRMAN (continuing). By a unanimous vote to offer an amendment to the military affairs appropriation bill, which will be in the Senate now within the next few days.

Mr. BOWER. I see your point.

The CHAIRMAN. To continue the work.

Mr. BOWER. Of course, $7,500,000 won't finish it.

The CHAIRMAN. Oh, no; we do not expect it to. Are you opposed to that?

Mr. BOWER. No, sir.

The CHAIRMAN. Then that is clear.

Senator HEFLIN. You want to see the dam completed and work begun on it?

Mr. BOWER. If you complete it without legislation, then it is our fight alone. They will say it is a wonderful power, and it should not be used for the manufacture of fertilizer.

Senator HEFLIN. And after this power is provided what you want to see is to see that it is used in the manufacture of fertilizer?

Mr. BOWER. Absolutely.

Senator HEFLIN. That is your position?

Mr. BOWER. Absolutely.

Senator KEYES. That is, the only way of getting it through is to complete the dam, to make the appropriation now?

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The CHAIRMAN. Surely.

Senator KENDRICK. There is another thing on which I want to be quoted here, which I think is highly important, so far as I am personally concerned. I am now and have been right along agreeable to action to make any final arrangement with Mr. Ford that will hav his stamp of good judgment and common sense in connection with the manufacture of fertilizer and the operation of that dam after it is built, but there are two points which I am unwilling to go along on, and I never will go; and one is to turn over that power in the form of a monopoly to Mr. Ford or to anybody else. I do not believe that we ought to tie it up for a long period of time, and I do not believe that any Member of Congress who has the best interests of the country at heart will agree to that form of monopoly any more than any other kind. That is the thing we have been trying to fight right along.

The CHAIRMAN. We will adjourn here until to-morrow morning at 10.30 o'clock.

NOTE.—Mr. Levering's statement following was made on May 5, 1922, and is here printed to preserve continuity of his presentation.

STATEMENT OF MR. J. H. LEVERING, CIVIL ENGINEER, LOS ANGELES, CALIF.

Mr. LEVERING. My name is J. H. Levering; I live in Los Angeles, Calif.; I am a civil engineer; I have been in the practice of the profession for about 30 years or over; I have visited Muscle Shoals before the work shut down in June of last year, and I have visited it since, for the purpose of investigating the project for putting in a bid for two different clients. I am appearing in this case simply as an American citizen, to give you the benefit of any information that I may have.

The CHAIRMAN. Well, we are glad to have that kind of a witness.

Mr. LEVERING. If you would let me, I will answer a question that has been asked two times that I know of—"why the Government engineers could not build the thing as cheap as private engineers?"—and I want to answer it. It is not because the Army engineer is not a competent man or because he is not trustworthy, or anything like that. They are as good a class of engineers as you will find anywhere. Of course, some of them are not equal to others. The reason is that the private engineer may have had experience in a certain line of work, and he knows ordinarily what equipment could economically handle that work. The Army engineer has got to investigate that and get that information together before he can go to work. It is out of his line. He is educated as a military engineer.

In the case of Dam No. 2, that equipment is already on the ground. That part is all over with. It has cost the Government a good deal of money. A private contractor could have moved his equipment in and gone to work quicker than the Army engineers did; but he is there, and the equipment is there, and it is doing good work, and with that equipment the Government can do the work cheaper than you could get a private contractor to do it. I have watched them carefully. That man you have there—his name is Colonel——

The CHAIRMAN. Colonel Barden?

Mr. LEVERING. Colonel Barden. He is an exceptionally good man. He is in a line of business that you could hardly expect him to develop as quick as he did in that line of work. I was surprised to find it. It is conscientious work and as good work as I ever saw.

They have got 30 locomotives on 28 miles of track. That is more than a private engineer would put on that amount of track. But the Ordnance Department was building the buildings at the same time the Engineer Department was building the dams, and they duplicated their construction.

The CHAIRMAN. How many engines did you say?

Mr. LEVERING. Thirty engines when I was there, and they are all in good condition, too.

Senator KENDRICK. Twenty-eight miles of track?

Mr. LEVERING. Twenty-eight miles of track; yes. But they were in a hurry.

The CHAIRMAN. I don't think there were that many there when they quit work, were there Major?

Major BURNS. Twenty-eight miles of track?

The CHAIRMAN. Yes.

Mr. LEVERING. There were at the time I was there.

Major BURNS. No; I don't think so. I will check that up.

The CHAIRMAN. I think you are right on the mileage of railroads. They connect with both railroads on each side of the river.

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Mr. LEVERING. It is good track. It is all 80-pound steel; and is good, first-class track.

The CHAIRMAN. It seemed that way to me.

Mr. LEVERING. It is better than I would have put in.

Senator NORBECK. Do I understand you to say that the unusually large number of locomotives resulted from the purchase by two different governmental departments working without coordination?

Mr. LEVERING. Yes; that is all. There was no scheme there, no rivalry, or anything like that.

Senator NORBECK. They had just bought a lot of stuff they didn't need?

Mr. LEVERING. They needed them at the minute. They were in a hurry. The Ordnance Department was working on these buildings and the engineers on the dams; and it looks now, when you see them all working on the dams, as if they have got more than they need.

The CHAIRMAN. They have got 76 cars, I believe.

Mr. LEVERING. One hundred and thirteen, all told; the dump carts and all.

The CHAIRMAN. I was speaking of the cars at the dam.

Mr. LEVERING. They have got 113, including the dump cars.

The CHAIRMAN. Of course, there may have been more when you were there.

Mr. LEVERING. Yes.

The CHAIRMAN. When were you there?

Mr. LEVERING. I was there in June, I believe it was about the 1st of June.

The CHAIRMAN. That was a good while before we were there.

Mr. LEVERING. They were working when I was there. Altogether they had that many cars, dump cars and freight cars. It is absurd to say that anybody could take that equipment and cut that price very much. If he did, he would not be doing as good work as that man is doing. That man is doing good work.

Senator KENDRICK. And they certainly could not improve on the quality of the work?

Mr. LEVERING. No; they could not. I don't think so. I never saw a better piece of work done than that is in my life, and I have seen quite a good deal of it. That work is all right. I am not an Army engineer, and I am not very favorable to them, but that man is all right.

The CHAIRMAN. You say you are not an engineer?

Mr. LEVERING. Not an Army engineer, I say.

Senator NORBECK. The subject was opened up here, and we are discussing Government engineers, and I want to say that what little I saw down there I was well pleased with, but speaking of the experience of different engineers in different lines, I suppose that a man in private work has certain advantages of training that an Army engineer does not get.

Mr. LEVERING. Yes. You can get him to work quicker.

Senator NORBECK. And would it not be fair to assume that the man who has got in the habit of depending a great deal on the balance sheet, on making both ends meet, on filling the bill, gets a line of thought into his work that a man does not who has always been on a salary?

Mr. LEVERING. That is right, too.

Senator NORBECK. As a rule.

Mr. LEVERING. But that piece of work, a man couldn't beat that, the way it is being done.

Senator NORBECK. The quality of the work.

Mr. LEVERING. And its cheapness, too.

Senator NORBECK. Do you mean to say that the sixteen or seventeen million dollars that have been put in there have shown big results?

Mr. LEVERING. He has got more in equipment than I would have; but from now on, after the equipment goes in—that was charged up to that work——

Senator NORBECK. From now on, but at the beginning, you would have made certain changes, and there are some advantages that private engineers would have gained from planning, and such as that?

Mr. LEVERING. Yes, sir.

Senator HEFLIN. Do you think at the time this dam was put in, that part of it that had been completed, that private enterprise would have saved very much money on it, considering the rush and the fact that it was being built to meet the demand of war, and all that?

Mr. LEVERING. I don't believe it would very much. You must remember this, that these men were on salary. They were brought there, as they told me, and taken away quickly, and another man took his place, and they didn't really have a chance. It was not a case of ability; it was a case of hurry. I don't believe

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that under those circumstances anybody could have done much better, but it has cost more to get the start, to get the work woing.

Senator NORBECK. I was grieved over a few things I saw there, but they gave me such very plausible explanations, which is the easiest thing in the world to do. For instance, more than a million dollars worth of electric equipment that has laid there for two years and would not be used for two or three years more, that could now be purchased for one-half of what was paid for it at that time.

Mr. LEVERING. That is right. But that is because of the rush, and these men came there and took hold of the first thing they saw.

Senator NORBECK. I don't believe a man spending his own money would be liable to make that kind of mistakes, do you?

Mr. LEVERING. No. But these men came there in a rush and took hold of the first thing they saw.

Senator HEFLIN. Your position is that private enterprise would be able to do the work quicker than the Government?

Mr. LEVERING. If he starts from the ground up, yes; because he is trained to get equipment for that line of work.

Senator HEFLIN. Mr. Ford claims if they would turn over this dam to him down there and let him construct it under his supervision he will push it along to early completion and do the work cheaper than the Government. Do you think he can do it?

Mr. LEVERING. I don't know what experience he has had in this particular line of work. If he has not the necessary experience he will be like the Army engineer; he has got to practice.

Senator HEFLIN. Don't you think he would get the best engineer and the best help that there is?

Mr. LEVERING. I don't know. He never got me, so I don't think he has gotten them.

Senator HEFLIN. Well, he didn't get one of the best, then. If he should get you you think he would be able to do it much cheaper than the Government would do it?

Mr. LEVERING. I could not finish that Dam No. 2 a bit cheaper than the Government could. I admit that.

Senator HEFLIN. You could not?

Mr. LEVERING. No. I could not take Dam No. 2 now and finish it up any cheaper than the Government could.

Senator NORBECK. Partly because the Government has got the equipment on the ground?

Mr. LEVERING. Yes. And these men that are there—I don't know who the other man is that is helping him, but they are all right. I take off my hat to them all the time. We are just talking along here, and I don't want to criticize anybody, but I am just giving you a few little illustrations that struck me. If I was going to build Dam No. 1 down there I think I could beat the Government engineers quite a good deal, and this is the way I would do it: Here is Dam No. 2, about 95 feet, we will say, high. Then the ground drops down here until you have to put up Dam No. 1, which would be about 12 feet high, to get the back water, to get navigation to the foot of Dam No. 2. If you were to open a navigation channel to Dam No. 2 and use that rock—it is a rock-bottom river—and put that rock into Dam No. 2, you would save that. It costs you more to get the rock into the dam, but what you save on the opening of the channel would make that cheaper than it would be to build Dam No. 1.

The CHAIRMAN. You mean to build Dam No. 1?

Mr. LEVERING. Build Dam No. 1, yes. Then you add about 8 per cent to the efficiency of Dam No. 2. You have that much more of a drop.

The CHAIRMAN. In other words, instead of spending the money to build Dam No. 1, you would spend it to excavate a channel from Dam No. 2 down to where Dam No. 1 would be built?

Mr. LEVERING. Yes. I would do that if I was doing it right now, because I could put that rock back in Dam No. 2. There is a million yards to go into Dam No. 2 yet. If it was not for that, I couldn't do it.

The CHAIRMAN. Have you ever estimated what it would cost to take that rock out that it would be necessary to excavate? That would be about how many miles?

Mr. LEVERING. It is about 2 miles, I think.

The CHAIRMAN. I think it is 3.

Mr. LEVERING. I think it is about 4,000 yards.

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The CHAIRMAN. Do you know, Major?

Major BURNS. I could not answer that, but I should guess it is about 2 miles.

Mr. LEVERING. I think so, but I think about 4,000 yards.

The CHAIRMAN. You would have to excavate practically the whole distance?

Mr. LEVERING. I estimate that rock taken out of there at $4, and it is worth over $2 in Dam No. 2, and by taking that up and charging it back to Dam No. 1——

The CHAIRMAN. You use that material and put it right into the dam?

Mr. LEVERING. Yes. But I couldn't do that after the dam was finished.

The CHAIRMAN. I understand. You have to do that now if you do it at all?

Mr. LEVERING. Yes, you would have to do it right now.

The CHAIRMAN. I never thought of that before, but it seems to me that is a very good suggestion for the engineers to consider, and of course if you did that you would add to the efficiency of the dam, because you would not be bothered with the tail water there.

Mr. LEVERING. No; and your extra fall would pay interest on your money all the time.

The CHAIRMAN. And you never would be to the expense of keeping up the lock in that Dam No. 1?

Mr. LEVERING. No, you never would.

The CHAIRMAN. You would eliminate that entirely?

Mr. LEVERING. And that tail water would keep that channel open, too.

The CHAIRMAN. That is a very fine idea.

Mr. LEVERING. That just happened to come right now. That is one thing that I would have done.

Now, I want to talk a little bit about one of these bidders, and in doing that the remarks might apply to all. There is no use to go into all of them, but I will just talk about one.

Now, I am an American citizen, and if there is anything that gets me it is the way this thing has been fooled with here before this committee, and I want to call your attention to a few things. I went to Muscle Shoals, and I might just as well tell the whole truth about it. I went to Muscle Shoals for some of the parties, and Mr. Engstrum is one of the parties that contributed to the fee. He contributed $200 out of about a $600 fee, and they were figuring on taking it. Now, I came back and I drew up with them a bid to offer to this committee, and we went over, or took it over, to Mr. Weeks, and I thought we had a very fair offer, and one day I saw changes in it, and I walked out of the office, and would not have anything to do with it. The thing was fooled away, practically, and I want to call your attention to the things in it that no American will stand for, and you can trace those things into the other contracts.

He says to give him, upon the signing of the contract, all of the loose personal property on the job except the food supplies, whether needed for construction or not, and he will contribute a capital of two million or two and a half million dollars. Now, that property will scrap at three and a half million dollars that you give him. You have got to give him material whether it is needed for construction or not, and he will sell it to the Government, if he finishes the dam, or sell to the contractor. That is, you give him three and a half million dollars and he will get five millions dollars out of it, and capitalize himself. He comes here with his pockets wrong side out, takes property from you, capitalizes himself and makes a big profit by selling it back to you when it goes into that dam, whether it is needed for construction or not. Those words ought to put him out of this committee. I would think so. If he said "things that you could not use for construction" there might be something in it, but he puts that in there.

Senator HEFLIN. Who said that?

Mr. LEVERING. That is Engstrum.

The CHAIRMAN. Yes.

Mr. LEVERING. Now, then, there is another thing he said. They want you to finish up the steam plant at No. 2, put in 30,000 kilowatt equipment there, and if you do that he will take it and make nitrates. Now, it will cost you—and this is a low figure—at least $4 a ton; you can not get your coal there much cheaper. It will cost you $6,000 a day to run that plant, and they get one-third, which is $2,000 a day, of the product. If you sold the power for what it cost, and you would have to sell it for that, he would get $2,000 of it, and he would reduce that 20 per cent only, which would give him still over a thousand dollars a day that the Government would have to pay him for operating that plant. That 20 per cent looks like he is dividing his profit, but he is not coming any-

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where near it. You see, when you burn $6,000 worth of coal a day, about 1,500 tons a day, you are running into $2,000,000 a year, and you have about two years to go before you can get any power from any other source, and he is not satisfied with that profit they want you to go ahead and finish up No. 2 so that they can increase their profits that much.

Now, as to making nitrates, they are like the other contractors that are going to make nitrates for an amount which would net them money. But assume that they do. He says that he is going to generate his hydrogen by elecricity. Now, this gentleman over here (Major Burns) is in the Ordnance department, and I think he will tell you I am not far from right when I say that when you commence generating hydrogen from steam generated electricity, when your equipment is steam actuated, and when you want a direct current, and have to use alternating current, your hydrogen will cost you so much that it will put your plant way to the red. It would be absurd. It would be anything but businesslike. If you had secondary power there, temporary power that you could not market safely, you could use it and work the cells that generate the hydrogen, because it would be all right in that case, but when you generate current by burning coal to make hydrogen, there never would be more expensive hydrogen in the world than that. It would be perfectly impossible—perfectly absurd.

And, as the Chairman very correctly remarked to the gentleman in his testimony, he says, "You are neither an engineer nor a chemist." That was very well put, I thought, at the time.

Now, these things sometimes ought to be given consideration. I don't see that an offer like that, that asks for all the capital to come to the Government and then a bonus besides——

The CHAIRMAN. When you come to that, isn't that pretty near true of all of them?

Mr. LEVERING. I would not be surprised but what it was. But I simply took up that one as a horrible example, that they would not have to have one cent in this, and they would have all the money they needed while they were burning up that $6,000 worth of coal, I think. They certainly would live well. I think a thing like that either ought to go to the grand jury or the waste basket. I don't think it ought to come to this committee. I never saw a think like that before. I would not have a thing to do with it, and it has to be pretty bad before——

The CHAIRMAN. What ought we to do with it?

Mr. LEVERING. I would send it to the grand jury, I believe.

The CHAIRMAN. I mean with the power down there? What ought we to do with that Muscle Shoals, taking into consideration here that we want it for the manufacture of fertilizer in peace times, and we want to be prepared in nitrogen in time of war.

Mr. LEVERING. I have thought that thing over for a year, Senator. I have been paid for it. It is quite a problem, and this is my opinion. Now, I have taken quite an interest in your bill. I think that all the power that could be generated in Dam No. 2 and Dam No. 3 could be used immediately—not all of it by the nitrate plant, but it all could be marketed immediately. I know that could be done, because I investigated it very carefully. It could all be marketed, and it has got capital stock there to carry that proposition. Now, in your bill—you know there are two laws in this country that have been tried out, and one of them is the national-bank law. In 1830, along there when the banks were about the only corporations doing business in the country, they were attacked by every legislative body in the country. In fact, they put the national banks out of business for a time. Then the States took it up.

Senator HEFLIN. Wasn't it about to put everybody else out of business, and was not that the reason they put it out of business?

Mr. LEVERING. It was not properly adjusted—that is, the law was not—but now you take a national-bank note, under Government guaranty and supervision, and I don't care what country you are in you get a dollar back for your bank note. It is the most perfect piece of legislation this country has ever known. It is not only good in this country but every other country looks up to our national-bank note, and that is for this reason, that the bank is partly under Government control and partly under private ownership, and the private owner can not, under any circumstances, vitiate his own security. The Government holds it in such a way——

The CHAIRMAN. Even though the bank fails the bank note is good.

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Mr. LEVERING. The bank note is good. Now, I think the Senator's bill here, if it goes a little bit further and puts in the power and somebody that can use or sell that power, Mr. Ford or anybody else could sell or use it, and make that guaranty a return on the Government money going in, and it will do that if it is handled right; then put the Government authorities in there to see that they do do it right, and you could start that thing off to-day and never give up a dollar's worth of that property, and finally pay for it.

Now, I have a friend here in town who is an attorney and who has had 20 years' experience in Congress. His name is James T. Lloyd. Maybe you know him.

The CHAIRMAN. Oh, yes; we know him very well. I think we all know him.

Mr. LEVERING. I went down and took your bill down to him, and gave him my ideas, and asked him to draw that bill with those suggestions in it. He told me he would do it, and would do it this afternoon, and I would like to bring it up to you.

The CHAIRMAN. All right. What modifications of the bill would you have to make to conform to your ideas?

Mr. LEVERING. I would like to fix it this way. At least, I would. I may be wrong about this, but I know that the power in excess of what is used at the nitrate plant—the nitrate plant is going to run at a loss.

The CHAIRMAN. Yes.

Mr. LEVERING. Just the same as the printing of the bank notes goes at a loss. There is no revenue in that. It is one of the charges that has got to go up against the plant, and in operating the nitrate plant that has got to be one of the charges.

Senator NORBECK. May I ask a question in regard to that matter? With the best of equipment, with the best of methods, with 4 per cent money, nitrate can not be made at a profit? Is that it?

Mr. LEVERING. No; I am not sure of it.

Senator NORBECK. Therefore, in order to get cheaper nitrate the Government must pay a bonus in one form or another? That is what you mean?

Mr. LEVERING. Yes; and I think if you would make Dam No. 3 make good now it would more than cover that deficit.

Senator NORBECK. In other words, instead of a cash bonus we might use that as a water-power bonus?

Mr. LEVERING. Exactly; because it is going to waste there and it is a menace to navigation.

Senator HEFLIN. In other words, if they finish Dam No. 3 then they can make nitrates at a profit?

Mr. LEVERING. Sure; that is, operate the plant at a profit.

Senator NORBECK. But, on the other hand, if the current generated at that plant was sold it would bring a revenue. Therefore you would get as much bonus that way as the other way?

Mr. LEVERING. Yes, sir.

The CHAIRMAN. The only difference is in this case you utilize water power that would otherwise go to waste, and if you pay a cash bonus it would be a direct payment out of the Treasury of the United States.

Mr. LEVERING. Yes, sir. Mr. Lloyd is a better talker than I am, and I am going to get him to come down and explain the bill to you. We have been working it out, and we know the power can be sold in two different places. It can be used on the ground for the manufacture of phosphoric acid and aluminum. Both raw materials are there. There is no use to let it go to waste a minute longer.

The CHAIRMAN. What is your idea, that the Government retain the ownership of everything?

Mr. LEVERING. Sure. Why, I will tell you why the Congress ought to retain the ownership. When this war was declared on the 6th of April, 1917, my wife and my boy and I went to the breakfast table, and he got up from that breakfast table and within an hour he enlisted to help this war out. I went down town, and I was a little too white headed to get into the Army, so they put me into this American Protective League, looking after the slackers and selling bonds.

The CHAIRMAN. You had a harder job than he did.

Mr. LEVERING. Yes; I did. And when I went around and saw people whose sons went into the Army, and they were afraid they would not have clothing or munitions or something, and they just cut down to the bone to buy bonds, and

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then the idea of going and giving it to somebody here just makes me sick. It is sacred money. A lot of that money is blood stained, and all of it, or most of it, is sweat stained, because that is the sort of people who bought the bonds. So I say a lot of it was sweat stained. It came from that kind of people.

Senator HEFLIN. Mr. Ford's people claim that they will produce fertilizer at half that price which they now sell for.

Mr. LEVERING. Yes. I hope he will.

Senator HEFLIN. And if they do there would be a saving of about $100,000,000 a year to the farmers of the United States.

Mr. LEVERING. That would be a good saving.

Senator HEFLIN. In a hundred years that would be billions of dollars, and at the end of a hundred years the lease expires, and Mr. Ford has paid to the Government more money by that time than the Government invested at the outset; and not only that, but the river has been made navigable for miles and miles and a great industrial community has been built up, and the whole farming population of the country has been served. Now, don't you think the Government is doing good business to go into a thing like that?

Mr. LEVERING. If that was their only remedy, I should say so, certainly, if it was the only way to get nitrates. But I feel this way. I am for this Government first and then for Mr. Ford afterwards. If the Government can do a better job and safer job than Mr. Ford can, I would let the Government do it. If they can not do it, why, then, let Mr. Ford do it.

Mr. Ford during the war went out to adjust the rights of nations. He took the authority out of Congress and went over there and tried to make peace by hand, and he couldn't do it when he got over there.

Senator NORBECK. You are afraid this might be another peace-ship affair?

Mr. LEVERING. Yes, sir.

Senator NORBECK. Well, then, he came back and made a lot of supplies and material for the war?

Mr. LEVERING. Yes.

Senator NORBECK. He rendered a great service in that, didn't he?

Mr. LEVERING. Yes, sir.

Senator HEFLIN. I take it you are in favor of Mr. Engstrum's proposition instead of Mr. Ford's?

Mr. LEVERING. No, sir. I think that if this bill was so that it could not run away with itself like the Shipping Board and the railroad control bill, if it is kept within limits like the national bank law, this is the bill that I would favor.

Senator NORBECK. The Norris bill?

Mr. LEVERING. The Norris bill; yes, sir.

Senator NORBECK. I don't understand Mr. Ford has offered to make fertilizer at half price. The only offer I have seen from Mr. Ford—as I understand it—is he will take on that work, and if he can make 8 per cent profit he will keep it going.

Mr. LEVERING. I should say for Mr. Ford that he did come here and he did make a lot of things for the Government.

Senator NORBECK. I am not criticizing Mr. Ford. I am an admirer of Mr. Ford. Other things being equal, I am for Mr. Ford.

Senator HEFLIN. His engineer has said that they can produce it at half the price it is selling for now.

Senator NORBECK. No one has ever made that statement in these hearings. I am getting tired of having this asserted day after day when it is not in the record, and was never testified to.

Senator HEFLIN. I assert that it was said by Mr. Mayo.

Senator NORBECK. I assert you said it several times.

Mr. LEVERING. Senator Heflin is right. Mr. Mayo did say that.

Senator NORBECK. That he would make it at half price?

Mr. LEVERING. He said he expected to.

Senator NORBECK. He hoped to. Oh, yes.

Mr. LEVERING. Yes.

Senator NORBECK. Did they agree to make it at half price? They agree to make it if they could make it at 8 per cent profit.

Mr. LEVERING. But Mr. Ford did not come here and look this committee right in the face and tell them so.

The CHAIRMAN. Oh, no. I don't think there is any doubt about the fact, now. Senator Heflin always says in his questions, "They claim they will be

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able to do it," or "they say they will be able to do it." But they are not willing to put that in the contract and agree to do it. They do say they expect to do that, but it is not in the bid.

Mr. LEVERING. Mr. Ford did say that his excess profits of $29,000,000 will go back into the Treasury. I believe they have not found the check yet, but probably they will.

Senator HEFLIN. But he does say he won't ask but 8 per cent profit.

Mr. LEVERING. Yes, sir; that is right.

Senator HEFLIN. If he does that he will reduce the price, because the fertilizer trust takes many times 8 per cent.

Mr. LEVERING. You are just exactly right, Senator. If the Government can not do any better than the Ford offer, as a matter of patriotism they ought to give it to him. That is right.

Senator HEFLIN. You know I feel like if they don't accept his offer there is not going to be anything done down there. Then they may get behind the bill of Senator Norris and that would be better than nothing at all; and, of course, go ahead and complete the whole thing; but suppose these fertilizer concerns and power concerns in the country—they are opposing any sort of development down there. They would rather buy it outright and let it stand idle always than to see anybody develop it. Don't you believe that?

Mr. LEVERING. Yes. You are right.

Senator HEFLIN. If that is true, Senator Norris may be gone, I may be gone, and others interested in the development may be gone.

Senator NORBECK. And Ford may be gone.

Senator HEFLIN. It may be 25 years before someone else will come along and do something with it, and here is a man that will do something with it.

The CHAIRMAN. He is just as liable to die as we are.

Let me ask you——

Senator KENDRICK (interposing). I think I get the witness's viewpoint very well.

The CHAIRMAN. I want to ask him this question here.

Mr. LEVERING. I am not here against Ford.

The CHAIRMAN. You understand what all these offers mean?

Mr. LEVERING. Yes.

The CHAIRMAN. In your judgment, now, as an engineer, take Mr. Ford's offer. Is there not a great big thing in it financially for Mr. Ford, if we accept his offer?

Mr. LEVERING. Mr. Ford, in the first place——

The CHAIRMAN (interposing). Just in a general way, now, in your judgment. Is there a big profit for him?

Mr. LEVERING. He would make $50,000,000 if he never turned a wheel.

The CHAIRMAN. $50,000,000?

Mr. LEVERING. If he never turned a wheel.

Senator HEFLIN. Let him explain that, Mr. Chairman, how he could make that $50,000,000.

The CHAIRMAN. Let me ask this question. Suppose he organizes this corporation, or this profitable venture and then dies, as he must, within the next 20 years, and more likely within the next 10, with this big profit ahead, and the corporation is bound only by what the contract provides for, would you not expect that that corporation, with the opportunity for profit ahead of it that would last, say 85 years—that is assuming he will live 15—would become the subject of any and every profiteer in the United States who had the ability or the money to get control of it?

Mr. LEVERING. That is the history of corporations.

The CHAIRMAN. And would they not then rely not upon the dead man's word, what he said here at this table that he expected to do, but on the letter of the law, upon the thing written in the bond?

Mr. LEVERING. Like the Alabama Power Co., exactly.

The CHAIRMAN. Yes, just exactly.

Would you not expect that the Alabama Power Co. would be controlling that corporation after Mr. Ford died? Would you not expect the Alabama Power Co., with its great network of wires spreading all over that country down there, would be the one that would want to get hold of it, and would they not be willing to pay an enormous price to get hold of it?

Mr. LEVERING. They are offering to buy it now.

Senator HEFLIN. Let him show how Mr. Ford would be able to make $50,000,000 out of it by letting it stand idle.

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Mr. LEVERING. I didn't say by letting it stand idle. I mean by the time it is ready to operate. I mean the project could be bonded or sold on the basis of $50,000.000 more than he put into it at the time it was finished, without turning a wheel.

Senator NORBECK. You mean, in other words, if the Government will give you this eighty or ninety million dollars worth of property for five or six per cent of what it cost——

Mr. LEVERING (interposing). Less than that.

Senator NORBECK. And, in addition to that, they will furnish you thirty, forty, or fifty million dollars of 4 per cent money for a hundred years——

Mr. LEVERING (interposing). You could take those two tracks and——

Senator NORBECK (interposing). Capitalize them and sell them for $50,000.000?

Mr. LEVERING. Yes, sir; I could do it and capitalize it. I have been in railroad work a good deal and I have seen money raised on corporation property and I know the process you go through; but I never saw a man come to a bank with a proposition like this, and say, "you give me $50,000,000 and loan me all the money I want and I will fatten on it."

Senator NORBECK. I will put some more in, and if what I put in additional will earn me 8 per cent I will make fertilizer for you.

Mr. LEVERING. I never saw anything like that.

Senator HEFLIN. You know the contract has not been drawn up with Mr. Ford.

Mr. LEVERING. No.

Senator HEFLIN. But when it is he has said here what he will do, and the Attorney General of the United States would be consulted, I suppose, and we will fix up a contract that would bind him specifically to do certain things.

Mr. LEVERING. Yes.

Senator NORBECK. And would you compel him by mandamus to sign it?

Senator HEFLIN. No. If he did not sign it he would not have the contract, but if he did sign it and give a bond we could compel him to comply with the conditions.

Mr. LEVERING. I suppose you could.

Senator NORBECK. How could you when the contract is not signed by Mr. Ford, but some new corporation to be formed with small capital?

Mr. LEVERING. He has not even agreed to go into that corporation, you will notice.

Senator HEFLIN. Could we not make the contract bind the corporation?

Mr. LEVERING. I believe you could.

Senator NORBECK. Can you bind the corporation more than its capital? If its capital is one-fifth of the property, what guaranty have you got?

Mr. LEVERING. As I say, it is not a proposition that one would go to a bank with to finance. I would not take it up with a bank except by letter. I would not show up there personally.

Senator HEFLING. Suppose the corporation declines to comply with the contract, what do you suppose the Congress would do by joint resolution?

Mr. LEVERING. I don't know.

Senator HEFLIN. Would it not declare the contract null and void? Would it not end the life of the lease?

Mr. LEVERING. I believe you ought to.

Senator HEFLIN. There are many ways we could force compliance with the contract.

Mr. LEVERING. But he has walked away with all the property.

Senator NORBECK. But Mr. Ford has never agreed to sign any contract with the Government. It is true a corporation could be formed.

Mr. LEVERING. That is the way I want to see the contract. I am not here to fight Mr. Ford or to keep him from getting this contract if he has the best offer.

Senator NORBECK. I am in favor of Ford, but I don't want to fool myself or anybody else.

Mr. LEVERING. Yes.

Senator KENDRICK. As I understand the witness, he is not here to advocate the cause of any one of the men who have propositions before this committee; but what you want to see before this committee acts is a business proposition?

Mr. LEVERING. Yes; exactly.

Senator KENDRICK. I would like to see it myself, and I have not seen it yet.

Mr. LEVERING. I have put a lot of time in this thing, and I just felt, if I didn't do any good, I would like to come and talk to you about it. I think that the Engstrum contract would be a scandal if it was ever signed up.

Senator HEFLIN. Whose contract?

Mr. LEVERING. The Engstrum contract would be a scandal if it was signed up. This man came here and said something about Goethals. Mr. Goethals did not show up here. I noticed that.

Senator HEFLIN. You believe Goethals is not——

Mr. LEVERING (interposing). I think he is a long ways from here. I look upon Mr. Goethals as a great man, and I do not believe that he——

The CHAIRMAN (interposing). If we will treat Engstrum the same as it is desired to treat Ford, we would have to take that word for law that Goethals was going to have charge of it. They are not bound up in their contract that Goethals will have anything to do with it. On the other hand, Ford's plan says they expect to make nitrate at half price, but there is nothing in the contract that binds him to do it.

Mr. LEVERING. A number of years ago General Grant in New York got in with the banks and got tangled up, you know. Goethals may do the same thing.

The CHAIRMAN. General Grant got the worst of it.

Mr. LEVERING. Yes, sir.

The CHAIRMAN. And ruined a very beautiful life's reputation and dragged his friends down to ruin, and he died with a broken heart.

Senator HEFLIN. They say they will produce fertilizers cheaper than they are being produced now, and we do know that the Fertilizer Trust is fighting to the death Ford and his proposition.

The CHAIRMAN. Senator, if this is utilized, as I want to see it done, to make fertilizer only with the object that we will cut the price down, no matter who does it——

Senator HEFLIN (interposing). Suppose it will do that, I don't think Mr. Ford, probably, or anybody else, would sign a contract that he is going to go down there and take up a nitrate proposition and guarantee he will make it for half price, but he does say, or his representatives do, that he will make that cheaper than it is now being sold, and Mr. Mayo, his chief engineer, said about half.

The CHAIRMAN. Yes; but have we got any way of making them do it without signing a contract? We have no way to force them to do it except by a contract.

Senator HEFLIN. It is lying idle now.

Mr. LEVERING. As an American citizen I am saying that we have in this country no nitrate source. That is, we have no dependable source of nitrate. When the law was passed establishing Muscle Shoals I looked upon that as the last clause in our declaration of independence. We then were independent of every nation. Now we are not independent even of that little 2 by 4 nation in South America that makes annually millions of dollars off of our enterprises by putting an export tax on it. They have got us tied up. I was in hopes that the great purpose for which that dam was started would be carried out. It was a sacred contract, as it looked to me, to the American people, that we were at least independent of the other nations.

Senator HEFLIN. Now, then, Mr. Ford proposes to enter into a contract with the Government to turn that plant over for the purpose of making nitrates in time of war.

Mr. LEVERING. Yes. But now I want to say, supposing he should go in——

Senator HEFLIN (interposing). Would not that make us independent of Chile?

Mr. LEVERING. You know that is his opinion of when it would be ready to make nitrates. That is his interpretation of that.

The CHAIRMAN. If we turned it over, he would have to pay for it, and it is his property.

Mr. LEVERING. You would have to buy it back again.

The CHAIRMAN. And we ought not to let anybody have it.

Mr. LEVERING. He does not turn that property back at the same price you give it to him, I notice.

But I want to finish this idea. In other words, in case war comes and that plant was in the hands of a pacifist or a slacker, or somebody in whose family was a slacker, that might make it very embarrassing for the Government to get into action quickly.

The CHAIRMAN. They might destroy the machinery like they did the machinery in some of the ships.

Mr. LEVERING. The whole lifeblood of our country is right in that one plant, and I say it ought to be taken care of very carefully. That is the lifeblood of

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this country if we are attacked, either internally or externally. It ought to be taken care of just exactly like the American people thought it would be when the money was voted.

The CHAIRMAN. And there is only one way to do that, and that is for the Government to retain this property?

Mr. LEVERING. There is only one way, and only one arm of this Government ought to be trusted with it, not because it is the only arm that is loyal, and I think the Army should be allowed to know all about that plant and to take care of it in that way that they can immediately know that it can be utilized.

The CHAIRMAN. There is not any assurance in any of these propositions—the Alabama Power Co.'s, Engstrum's, or Ford's——

Mr. LEVERING. The Alabama Power Co. is just as bad.

The CHAIRMAN. But what the corporation that is going to take over the property might be owned in Germany or Great Britain or France or Italy or Russia by the bolshevists, and that when we get into the next war, if we were so unfortunate as to do it, the enemy or people that we are going to war with might own the very property that we were depending on to make our explosives.

Mr. LEVERING. That is right. And I want to say that I do not see that we have any right to let that go out of Government control. If we could go out and buy nitrates anywhere in the country, that would be all right, like the cantonments, but that nirate plant can not be built in a day or in a year.

Senator KENDRICK. Are there not two propositions here? First, you are not finding any fault with the propositions these men are making?

Mr. LEVERING. No.

Senator HEFLIN. He is just against them all.

Mr. LEVERING. Now, Senator, you are not in favor of giving it to Mr. Ford, are you?

Senator HEFLIN. I am certainly in favor of his offer. I think it is the only way that we are going to get the development and secure the production of cheap fertilizers and relieve the farmers from the clutches of the Fertilizer Trust of America.

Mr. LEVERING. If you are right, Ford ought to have that proposition.

Senator HEFLIN. I say he ought.

Mr. LEVERING. But I am not sure we are in that shape that we have to turn the functions of this Government over to any man, I don't care who he is.

Senator HEFLIN. Then you would let that property lie idle just as it is; let it go to waste?

Mr. LEVERING. You could not use it in time of war and right now.

Senator HEFLIN. Ford said he would turn it over to us at any time.

Mr. LEVERING. I know.

Senator HEFLIN. He would contract to do that, and we could go down and take charge of it. Is there any way to keep us from doing that?

Mr. LEVERING. No; there is not any way at all. But, Senator, let us, I say, first, before that goes to Ford, look at it from the Government proposition and see if we can not solve it by the people, for the people, and in the interest of the people. If we can not, then let us give it to Ford, for Ford, and in Ford's interest. That is what I say. But let us try our own interests first.

Senator KENDRICK. I started to ask you a question a while ago and I was interrupted.

Mr. LEVERING. Excuse me.

Senator KENDRICK. You are not complaining about the propositions these men make?

Mr. LEVERING. No.

Senator KENDRICK. But you insist that the responsibility of deciding this thing is upon this committee?

Mr. LEVERING. It is indeed.

Senator KENDRICK. To decide it in the interest of the Government?

Mr. LEVERING. To decide it in the interest of the Government. And it is a very important question, too. It is a very important question.

Senator KENDRICK. Incidentally I have been very greatly impressed with the idea of allowing Ford to handle this, but I want Ford to submit a business proposition before we turn it over to him.

Mr. LEVERING. They said Mr. Ford and Mr. Edison were going to do wonders. There is about—I don't know how many thousand acres of land down there cut up into little bits of lots already, when Ford goes there——

Senator NORBECK. Do you think that some of these people, when they say Ford and Edison will do wonders, mean by wonders that they will boost the price of land they have for sale?

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Mr. LEVERING. The other day I saw a man who had lots for sale near Ford's plant. I said: "Who is boosting Ford?" I meant to bring some of the circulars down here and show them to you. I believe the propaganda that is going out in favor of Ford, lots of it is from men who will make ten or fifteen millions of clean-up on the sale of land. He says: "Mr. Ford will have to have part of this land, and if you will buy it now you can get a good price for it later."

The CHAIRMAN. You could hold up Ford?

Mr. LEVERING. Yes; I suppose he wants to hold up poor old Ford.

Senator HEFLIN. Is not that the case always where industry springs up?

Mr. LEVERING. Yes, sir; it is.

Senator HEFLIN. Is it not legitimate speculation by people who have money to go down and get in on the ground floor? Is not that usual?

Mr. LEVERING. Well, it is the practice. I never built a railroad into a town in my life——

Senator HEFLIN. Do you blame those people who have got money and think that it is a good investment down there for going and putting it in real estate?

Mr. LEVERING. I don't like it, and I will tell you why.

Senator HEFLIN. You don't like it?

Mr. LEVERING. No, sir.

Senator HEFLIN. Would not that put that money into circulation, and don't we need it in these depressed times?

Mr. LEVERING. Well, it is not good money. I have built railroads many times and always there was a boom in lots when we got in. I don't know how many times; but so many times, and the man that bought that lot is the man I felt sorry for. It never came up to his expectations.

I went to Los Angeles in 1878 and bought some property, and I still own property there. That one town did come up to expectations.

Senator HEFLIN. It is the fear you have for the poor fellows that will be hurt that causes you to feel that way?

Mr. LEVERING. The suckers; yes.

Senator HEFLIN. You don't want the suckers to get caught. You would rather just let it all grow up to weeds down there?

Mr. LEVERING. No, sir, Senator. I think that sucker money is behind all this inflammatory propaganda that has gone out. I think so.

The CHAIRMAN. You don't think it is necessary to have suckers in order to prevent the weeds from growing up?

Mr. LEVERING. No; I don't think so.

The CHAIRMAN. If we just keep the plant and operate it ourselves we will have neither weeds nor suckers?

Mr. LEVERING. Yes.

Senator HEFLIN. How would a lot of big fish live if it were not for the suckers?

Mr. LEVERING. That is right. That is the way they keep going.

The CHAIRMAN. Well, let us not help them any.

Mr. LEVERING. I want to say another thing. Of course, it is your business to give this to the best offer that comes along, and if Mr. Ford's is the best offer you would be derelict in your duty if you did not give it to him.

Senator HEFLIN. Which one do you think is the best offer?

Mr. LEVERING. I believe I would decline to vote in this case if it was up to me and I was in the Senate.

Senator NORBECK. You think you would prefer Senator Norris's bill to any of them?

Mr. LEVERING. Sure, I prefer Senator Norris's bill, but I think that really could be improved some. I think the Senator will admit that himself. I believe there is some improvement that could be made, Senator Norris, so that it would not be open to the objection that it would be open to in its present condition. I believe it is a lack of confidence in the Government to say to any man that we can not handle it, "You come and run this business for us."

Senator NORBECK. Do you live in Washington?

Mr. LEVERING. No, sir; I live in Los Angeles.

Senator NORBECK. I believe the people of Los Angeles have managed their business pretty well, haven't they?

Mr. LEVERING. The city does very well. They own most of their utilities, their electric lights and water.

Senator NORBECK. And they built that water enterprise at a very large expense, and did it economically, and have handled it efficiently?

Mr. LEVERING. They did it pretty fair.

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Senator NORBECK. And saved the people a lot of money over what they would have been compelled to pay had it been done by some corporation.

Mr. LEVERING. It has been a great asset to the city. The city has gone to a great deal of expense. It has been one of the public utilities that has been built so as not to bring discredit on the city. It could have been better. There is nothing perfect in this country or in this world. We don't expect that.

Senator HEFLIN. I didn't hear your opening statement. What business connections have you?

Mr. LEVERING. I am a civil engineer. I went down to Muscle Shoals in June of last year, before the work stopped.

The CHAIRMAN. He went all over that before you came in, Senator. That is all in the record.

Senator HEFLIN. You are in no way connected with any electric or power company?

Mr. LEVERING. No, sir.

Senator HEFLIN. Nor any water-power proposition in the country?

Mr. LEVERING. No, sir.

Senator HEFLIN. Nor any fertilizer proposition?

Mr. LEVERING. I will tell you what I did do: I went to Wilmington, Del., and took it up with the engineers of the Du Pont Co.—one of the parties I wanted to know about the nitrate business. I thought I could get them to take it.

Senator HEFLIN. The Du Pont Co.?

Mr. LEVERING. Yes, sir. I went over there, and I went over that nitrate business very thoroughly with them. They have about $50,000,000 invested in Chile, and they have tried air nitrate work a good deal, and they gave me the benefit of their experience, and their verdict was that they could not lose money much faster than by getting into Muscle Shoals.

Senator HEFLIN. Don't you think they don't want anything over here developed that would be in competition with their interests in Chile?

Mr. LEVERING. Sure, they don't.

Senator HEFLIN. They don't like to see Muscle Shoals developed and turned over to Ford, do they?

Mr. LEVERING. I will tell you just what they told me. I give it as their talk to me; and I think it is perfectly honest—that they did not want to go into Muscle Shoals. They made no offer for it, and I couldn't see why they didn't. They explained to me why they didn't. They could beat—even paying $11 import duty from Chile—they could still beat anything that was developed yet in air nitrate manufacture.

Senator NORBECK. Even with 4 per cent money they could not make fertilizers as cheap as they could ship them into this country from Chile? Was that their position?

Mr. LEVERING. That was their position; and I talked it over with them several days and went over the thing very carefully, and they convinced me. They might have been wrong, but I think if they could have got that supply of nitrates cheaper here than in Chile they would shut down in Chile in a minute and begin getting their nitrates here. But it was a matter of dollars and cents with them.

Senator HEFLIN. Why didn't you go to Mr. Ford and talk with him about it?

Senator NORBECK. This was after Ford was back with his peace ship?

Mr. LEVERING. I will tell you why I didn't go to Ford. I knew Mr. Worthington was talking with Ford, and I saw Mr. Ford's proposition earlier than a good many of you think I did. I thought that the Ford proposition was not in my line. I was not working with Mr. Ford, or anything.

Senator HEFLIN. Did you talk with Mr. Ford?

Mr. LEVERING. No; I never did.

Senator HEFLIN. Did you talk to any representative of Mr. Ford?

Mr. LEVERING. I have talked with Mr. Worthington and Mr. Mayo.

Senator HEFLIN. Did you ever intimate to them that you would be glad to join them in any work they were doing down there?

Mr. LEVERING. No; I never did.

Senator HEFLIN. Would you, if they had offered you sufficient inducements, have joined them in their project down there?

Mr. LEVERING. I would work for them, if I got the money I wanted, you see, but I have no idea——

Senator HEFLIN (interposing). That would have had some influence with you?

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Mr. LEVERING. It might have.

Senator HEFLIN. It probably would have weighed more heavily on your constitution than the situation now does?

Mr. LEVERING. Well, it probably would. But I want to say one thing, that there is no vacancy in the Ford work there.

Senator NORBECK. Are you looking for a job?

Mr. LEVERING. Not there; I am not.

Senator HEFLIN. You say there is no vacancy in his forces?

Mr. LEVERING. Not that I have heard of.

Senator HEFLIN. It looks like a closed proposition to you, then?

Mr. LEVERING. Yes; it looks like no chance to get in there, and I have never tried to get in. I have never endeavored to get in. I think they have got good men and their business is well handled. They don't need anybody else that I can see.

The CHAIRMAN. You think they don't have need of your services; they have enough good men already?

Mr. LEVERING. Yes.

Senator HEFLIN. But you did try to get the Du Pont Power Co. to take it?

Mr. LEVERING. I tried to get them to take over the nitrate plant or assist in operating the nitrate plant for the Arkansas Light & Power Co. The nitrate business kind of stuck them, and I went over to see what the Du Ponts would do to make up a combination, and that was all. I went there and talked it over with the Du Ponts with that idea in view. They treated me very nicely and went into the details of their manufacture very carefully.

Senator NORBECK. And it convinced you that you could not manufacture nitrate in competition with the Chilean product?

Mr. LEVERING. Could not. They could not do it.

Senator HEFLIN. I thought you said awhile ago if they got all these dams completed down there they could compete with anybody.

Mr. LEVERING. That would be as a plant; not as nitrate per se.

The CHAIRMAN. He means, as I understand, if you put it all together, you could make enough money on the water power to keep your nitrate plant going, and make money out of the whole operation.

Mr. LEVERING. Yes. You could then amortize the investment.

The CHAIRMAN. Yes.

Mr. LEVERING. But you could not amortize the investment on Dam No. 2.

Senator NORBECK. But if you had water power that the Government gave you you could hook up the whole proposition and make it pay?

Mr. LEVERING. Yes.

Senator HEFLIN. You are merely giving your opinion about that. You may be mistaken as to whether they could make that profitably or not?

Mr. LEVERING. It looks to me like they could.

Senator HEFLIN. You understand he has another process for making fertilizer ingredients and can make it much cheaper than the present plant. If he has got that you are mistaken, are you not?

Mr. LEVERING. Yes; I would be very badly mistaken if he has it.

Senator HEFLIN. You doubt that, do you?

Mr. LEVERING. Yes, sir; I do, and I will tell you why. The cyanamid process can be cheapened, that is certain. It can be cheapened and, as Mr. Mayo said when he was here, it is possible to work nitrate and aluminum together, but it is neither good aluminum nor good nitrate process. If you are going to be in a rush for nitrates, you would be tied down with your aluminum end of it. I think that the cyanamid process can be cheapened, but I don't believe that it could ever be brought down to the figure that a process similar to the Haber process can be brought down to. The Haber process is going to be a success or not depending on one thing: If you are going to have secondary power enough and often enough to generate your hydrogen. In the Haber process about 70 per cent of the money or 50 per cent, anyway—25 per cent of it goes into the generating of hydrogen.

Senator NORBECK. May I ask do you mean to say that there is a much larger per cent of power in that, so that cheapening the power will reduce the product more in the Haber process than in the other?

Mr. LEVERING. Yes. As I say, if you substitute power for the coke method of getting out the hydrogen. If you get cheap enough power. I want to explain to you now that 25 per cent of the cost of nitrates under the Haber process is chargeable to the generating of the hydrogen, and when it is generated it carries carbonic dioxide monoxide, then 50 per cent of the cost is in purifying

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the hydrogen, making altogether about 70 or 75 per cent of the process, is getting your pure hydrogen. If we have excess—which you would would have an excess of secondary current when you put both dams in operation, you would then get your hydrogen almost for nothing, and you cut off your 75 per cent plus the cost of maintaining the cells, so that I think it would be a very safe figure to say that if both dams were in operation and you had that excess of secondary power, you could cut the price down to about 50 per cent of what it is now.

The CHAIRMAN. The experts gave us the information that in the Haber process power was a very inconsiderable item.

Mr. LEVERING. It is now, because they generate the hydrogen from the coke process, you see.

The CHAIRMAN. Yes.

Mr. LEVERING. But I say if you can substitute that——

The CHAIRMAN. Can you, now? Is that a practical proposition?

Mr. LEVERING. Sure. This gentleman [Major Burns] can explain that to you. That may be done if you have the current cheap enough, but you can not, as Senator Butler says, generate your current with coal and do it.

The CHAIRMAN. I understand now, but if you get your hydrogen——

Mr. LEVERING. You could cut off 50 per cent of the cost.

The CHAIRMAN. Fifty per cent of the cost?

Mr. LEVERING. Yes, sir.

The CHAIRMAN. In doing that the question of power is the primary consideration?

Mr. LEVERING. Yes; that would be.

The CHAIRMAN. You propose to do that with secondary power?

Mr. LEVERING. Yes.

The CHAIRMAN. That is, power that can not be used all the time?

Mr. LEVERING. Yes.

The CHAIRMAN. Then you would only operate part of the time?

Mr. LEVERING. You would only operate cells part of the time.

The CHAIRMAN. Is this true: You would be operating those cells part of the time, but you would get a supply of hydrogen in excess of that which you could use while you were operating them; so that, say, you operated those for 10 months in the year you would have a supply of hydrogen enough to last you in finishing your process for 12 months? Is that true?

Mr. LEVERING. It would be a matter of adjusting the plant to do that thing.

The CHAIRMAN. In that way you would utilize your secondary power?

Mr. LEVERING. Yes. And then you could sell that primary power.

Senator HEFLIN. Then you would make it cheaper than Mr. Ford says he can?

Mr. LEVERING. You can cut off 50 per cent.

Senator HEFLIN. He says 50 per cent.

Mr. LEVERING. Under this basis.

Senator NORBECK. Couldn't you do that under the Norris bill as well as under the Ford plan? I say couldn't you do the same thing under the Norris bill as under the Ford offer?

Mr. LEVERING. Yes. I think the Norris bill—or, excuse me, the chairman's bill—could be adjusted just a little bit, and I believe that Senator Heflin would get right up and talk for it quicker than anybody.

Senator HEFLIN. I see the great good that will come from this making the river navigable, which is worth a great deal to the future of that whole country. It will bring down freight rates, and it will add this power that is going to waste, will put it to making fertilizers in time of peace and nitrates in time of war, and build up an industrial city there. It looks to me like the greatest hope we have is in the Ford offer. We are going on under the amendment that Senator Norris has already offered to complete Dam No. 2. I am talking about operating and doing something after we get through with this, and I feel that unless the Ford offer is accepted influences will be brought to bear, just as you suggested a while ago, from the Du Pont Powder Co. and every big and powerful political influence in this country, that will keep anything from being done at Muscle Shoals, unless a man like Ford, who has got the money to do it himself, gets hold of it.

Senator NORBECK. What might those influences do when Ford leaves it?

Senator HEFLIN. The corporation will be there then, and you have got it in a contract.

Mr. LEVERING. I want to say that I have been around the world a little b you know, and I may express this opinion, and it is just my opinion only, ar

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nothing but that, but as long as we are talking the matter out, if I know anything about anything at all it is railroad construction, add a little bit about the operation of it, and when I read in the papers that Ford had bought a railroad and was going to make a big per cent on the money clear, I watched the matter very thoroughly and saw in the report of the Interstate Commerce Commission some time afterwards where he had a deficit of $135,000 in one month in his operations, I said to myself, "Mr. Ford, your efficiency is in ringing the bell and blowing the whistle," and it may be that way here.

Senator NORBECK. You think he has got to make a great deal better success with the fertilizer business than he did with the railroad business or it will be a fiasco?

Senator HEFLIN. But his railroad is a paying investment now, is it not?

Mr. LEVERING. I think it came back to normal in the last month; I mean to making a profit. I think it did.

Senator HEFLIN. Well, you are talking about when he first got it and commenced to operate it.

Mr. LEVERING. No. The first month he ran ahead. He did not put up much money.

Senator HEFLIN. As soon as he learned the business he made it a paying investment, did he not?

Mr. LEVERING. Any road once in awhile will pick up, you know, but I do not think that the road, for the three months that he has had it, has been a profitable proposition. I do not think any railroad in the country is paying very much.

The CHAIRMAN. I do not think this has anything to do with this hearing, but don't you think in that very railroad operation there that Mr. Ford performed an example for the country that was very valuable, when he showed that he could take a railroad that was run down and operate it efficiently, making it successful, without any great deal of financial legerdemain about it, when he has made a success out of what had been a failure before when the magnates were operating it?

Mr. LEVERING. I hope he did.

The CHAIRMAN. Well, it looks to me as if he did it in that operation.

Mr. LEVERING. Of course, he has not gone broke yet.

The CHAIRMAN. No.

Mr. LEVERING. But the railroad has not accumulated any money yet, either.

The CHAIRMAN. Well, he took a railroad, as I understand it—I do not know anything about the details—when it was wrecked financially, was it not?

Mr. LEVERING. Yes; it was.

The CHAIRMAN. And doing nothing.

Mr. LEVERING. No; it was operating, I think.

The CHAIRMAN. Well, I think it was about to stop operations.

Mr. LEVERING. I do not know.

Senator NORBECK. To what extent is that additional efficiency due to his shipping his own heavy freight shipments over that line?

Mr. LEVERING. Well, he saved up his business, I imagine, and when he opened it he had a lot of good business to put in there. It was business that paid a big freight rate, and it was all first-class freight.

Senator NORBECK. Was it not somewhat like the short lines of the packers in Chicago, which they used to switch their cars on, in order to get a split of the freight rate, and which made the short-line operation a profitable one?

Mr. LEVERING. I do not know. I just cited that instance, that I noticed that there was a $135,000 deficit in one month, and I was just wondering whether Muscle Shoals would not have its bad months, too, if he had it. I was just wondering about that; I don't know. But I want to say that I am an American citizens, and if our Government can not function we ought to get Ford to do it and keep the country going.

The CHAIRMAN. Well, if we had to turn it over to somebody I would just as soon turn it over to Mr. Ford as to anybody I know, and I would much rather turn it over to him than to a lot of others; but I do not want to turn it over to anybody. Are you in doubt about our ability to function here?

Mr. LEVERING. No.

The CHAIRMAN. If we can not function we might as well go back to England and become one of her colonies again and let the King run it.

Mr. LEVERING. No; I have not said that you should give it to anybody, and have it run for you.

The CHAIRMAN. No; I know you have not.

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Senator HEFLIN. It has been a good while since we shut down work there, and I have not heard you complain about the Government failing to function.

Mr. LEVERING. Well, I went down there and looked it over and I was surprised. I know, of course, that there was a lot of extra money invested on it that would not have been invested if it was done quietly in times of peace, but I do not believe there was a dollar of that money that was squandered. I do not believe there was any graft down there at all. There were just acres of material there and miles of sewers.

The CHAIRMAN. There were lots of instances, I suppose, where they probably used bad judgment.

Mr. LEVERING. Yes; but you must remember that during that time the flu came on and there were from 40 to 70 funerals every day.

The CHAIRMAN. Is that so?

Mr. LEVERING. Yes.

Senator HEFLIN. Yes; they had an epidemic down there.

Mr. LEVERING. And they were all trying their very best to get out of there.

The CHAIRMAN. If I did not know that they had that difficulty in addition to the others.

Mr. LEVERING. Yes. I came back and a man asked me what I found there. I said I found a railroad, a club house, engines and sewers, and every damned thing but a dam. I could see that they were afraid of their lives there; they did not know who would be in the box next day. Now, you could criticize a lot of that work that you would not dare to citicize if you had been on the ground at the time. I am not at all dubious about that Dam No. 2 being built right.

Senator NORBECK. Was it a mistake to start the dam right during the peak of prices, when the dam could not be used in connection with the plant, anyway?

Mr. LEVERING. Well, I was not responsible for that.

Senator NORBECK. But that was a mistake in judgment, was it not?

Mr. LEVERING. I should think so, looking back at it now; but it might have been different then.

The CHAIRMAN. I suppose even though it did not commence operations—and I do not want to criticize anybody unless I have a reason for it——

Mr. LEVERING. Yes; that is right.

The CHAIRMAN. I suppose, however, it did not commence until after the armistice, when the preparations were all made.

Mr. LEVERING. Yes, sir.

The CHAIRMAN. And everything was done.

Mr. LEVERING. Yes.

The CHAIRMAN. The railroad was built across the river?

Mr. LEVERING. Yes.

The CHAIRMAN. And the mixing machines were all ready to go?

Mr. LEVERING. Yes, sir. But I want to say, gentlemen, that any man that would shut that plant down and turn back and depend on Chile, had better try to cut out our Constitution and turn us back to England. I will tell you it was a very embarrassing thing——

Senator NORBECK. The Government ought to make sure that we have plenty of nitrate plants in the country.

Mr. LEVERING. Yes. What is the use of having a gun without ammunition, and what is the use of putting your ammunition into the hands of a man if you can not tell whether he is loyal or not?

Senator HEFLIN. Don't you think the Government is functioning when it goes ahead and completes this dam, and then leases this property to Mr. Ford to make something that will cut prices to a great number of people in this country, that will make the river navigable, that will help commerce, and that will keep the plant open for the purpose of making nitrates in time of need? Is not it functioning when it does that?

The CHAIRMAN. If we were pushed up against it and there was only one way to do it and that was by a man who had to do it, that would be the proper thing to do, but it does not follow that we have to turn it over to a certain man just because we want to get a certain result.

Mr. LEVERING. If we have to get one man for all of our brains and enterprise, I think we had better get a king.

Senator HEFLIN. I am not suggesting that, but we are suggesting a proposition here to utilize this power down there.

Mr. LEVERING. It ought to be utilized to-day, even.

Senator HEFLIN. Suppose the Government should complete it and the Government went into the manufacture of fertilizers, how long do you believe it would

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be before influence would be exerted here to stop the Government from competition with private industry?

Mr. LEVERING. I want to be honest with you, Senator, and I feel that that might creep into the Norris bill. I am afraid that that might. That is the reason why I would like a guarantee behind that, to shut that out. That is the only reason.

Senator HEFLIN. You mean, to keep the Government from being in competition with private industry?

Mr. LEVERING. To keep the Government from being imposed upon.

Senator HEFLIN. Then the Government would have to keep it idle.

Mr. LEVERING. No. If the Government does that it had better give it to Ford a thousand times over.

Senator HEFLIN. But you would have the Government go into the manufacture of fertilizers, then?

Mr. LEVERING. In a way, I would like to have the Government watch that thing and be a part of it, so it could not be stopped.

Senator HEFLIN. Suppose the Government would start to manufacture fertilizers, don't you believe that every fertilizer manufacturer in the country would come down to Washington and use his influence to get the Government out of competition with them?

Mr. LEVERING. No; I do not.

Senator HEFLIN. And don't you think that, in due time, the plant would be shut down under the public opinion that would be created?

Mr. LEVERING. No. I do not think so, Senator, because, as I say, I was making an investigation to see what could be done with that nitrate, and I do not think anybody would want to shut it down if they could get nitrates.

Senator HEFLIN. In other words, they would like to have it run on a small scale; they are afraid that Mr. Ford will be a great competitor; is not that true?

Mr. LEVERING. No; I think the nitrate people—and I have been talking with them—would just as lief buy their nitrates here as in Chile.

Senator HEFLIN. Don't you believe that the fertilizer concerns are opposed to Mr. Ford's going into this thing for the purpose of making fertilizers?

Mr. LEVERING. I believe they are.

Senator HEFLIN. Don't you think it would be against their interests if he gets it?

Mr. LEVERING. Yes; I think so.

Senator HEFLIN. Don't you think that that is the motive behind their actions?

Mr. LEVERING. I do not think it is anything else.

Senator HEFLIN. Now, if the Government would take it and operate it on a small scale and just make the nitrates they would not care, would they?

Mr. LEVERING. I do not think it would be on a small scale. I think it would be a bigger operation than Mr. Ford would make out of it.

Senator HEFLIN. Well, do you think these other concerns would consent to the Government operating it in times of peace, in competition with them?

Mr. LEVERING. I think so, if they would make nitrates, because there would be their source of nitrates.

Now, one thing more. I have heard this raised so many times here, and I feel that I should give you one more idea there, and that is that it is not possible nor practicable for them to make concentrated nitrates and sell them to the farmers to be mixed. You have to have mixing plants to mix them I will tell you from my experience, and I have been an engineer and have noticed this, that in the last 20 years cement has come into use much more universally than it ever was before. We fixed, mixed, that cement with the aggregates with a shovel, turning it over, and we never could get a uniform mixture. Some samples would breaw easier than others; and along came the mixer man. He made a mixer, and he is getting it better and better every day. Now, that cement is mixed so that one sample is just as good as another, practically.

When we come to mix that little particle of active chemical so that it will not burn the root of that little plant you have to mix it very evenly over your aggregates, and I believe instead of selling to the farmer, that every county or community would have a mixing plant. In California the farmers sell their oranges and other fruit and vegetables through a farm bureau. They have their refrigerating plants and packing houses, and in almost every town they have a committee of farmers, a community service. I believe we could just put a mixer in there, and they could buy that and give it to the farmers and save freight in that way. Then you would have a well-mixed fertilizer:

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but when you have to put it in the wagon bed and mix it up, you can do it in a way that will not help the little plant that gets the live chem cal against it.

The CHAIRMAN. You may kill rather than nourish.

Mr. LEVERING. Yes. I know that from my experience in the mixing of cement. I know that that machine will mix it, and by and by you will work this out in that way. Every community will have a mixer, like a mill where you have your corn ground. There would be no use in mixing at Muscle Shoals and shipping it out. That would be wrong.

I am through now, I believe.

The CHAIRMAN. All right; we are very much obliged to you, Mr. Levering.

Mr. LEVERING. I thank you.

Senator HEFLIN. Mr. Levering, I believe you stated at the outset that you were not appearing here for any special interest?

Mr. LEVERING. No. I might say that I am appearing here for Senator Norris's bill.

Senator HEFLIN. You are?

Mr. LEVERING. Yes, sir; I will back that bill.

Senator HEFLIN. But you do not represent any other outside interest?

Mr. LEVERING. None at all.

The CHAIRMAN. We will adjourn here until 10.30 o'clock to-morrow morning.

STATEMENT OF MR. JAMES T. LLOYD, ATTORNEY AT LAW, WASHINGTON, D. C.

Mr. LLOYD. Mr. Chairman, for the record I suppose I should state something about who I am.

The CHAIRMAN. Yes, sir. Of course we all know that, Mr. Lloyd, but you had better put that in the record. Your own experience tells you just what you ought to put in the record.

Mr. LLOYD. Senator, you know, but there are some members of your committee who do not.

The CHAIRMAN. I presume that is true. They have come in since you went out of Congress.

Mr. LLOYD. My name is James T. Lloyd. I am a practicing attorney in Washington, D. C., formerly of Missouri, a practicing lawyer there; for 20 years I was a Member of the lower House of Congress, from 1897 until 1917. I have been practicing law in Washington since retirement from Congress.

You naturally wish to know at this time, and have a right to know, how it happens that I appear before you. I became interested in the power proposition while it was attempted to secure the legislation which would authorize the construction of what is known as the Keokuk Dam across the Mississippi River at Keokuk, Iowa. I had something to do with the preparation of that bill and its passage through the lower House of Congress. Since that time I have been interested in the water-power proposition, and while I was never on the Interstate and Foreign Commerce Committee of the House, which had charge of such bills, as a Representative I was deeply concerned in securing to the people of the United States the benefits which might accrue from the use of power which might be generated by the use of the falls in various navigable rivers of the country.

I have not had any direct connection with the Muscle Shoals proposition. I have none now. I have the interest that any public citizen, I think, should have in a matter of so great importance as this. I am not attorney for anyone. I am not interested for any interests that are concerned in securing any kind of control of the Muscle Shoals proposition. My immediate connection with this matter was brought about by a conversation which I had with Mr. Levering, who has previously testified before this committee. He came to me and talked to me about the Muscle Shoals situation and expressed a desire to bring about, if possible, some kind of proposition which would be practicable and would be workable and that would be acceptable to the Government and to business interests which might be connected with the enterprise. He has talked to me from time to time since that, covering a period of perhaps a month, about the situation and about the suggestion of what kind of a plan that might be effective.

It might seem a little strange that I should interest myself in a matter where I am not employed as an attorney and where I have no interest, either direct or prospective.

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The CHAIRMAN. Now, Mr. Lloyd, to those member of the committee who are as well acquainted with you as I am, that is not surprising at all. I assume that you have the interest here of an American citizen interested in the welfare of the people and the preservation of whatever, in your judgment, ought to be preserved in the way of the rights of the people, and any man who looks up your record while you were serving in the House of Representatives would understand why you would volunteer to come here if you thought you had any ideas that might be beneficial.

Mr. LLOYD. May I say, in addition, that I think I have a little more than the ordinary interest of an American citizen because of my connection with the legislative bodies and because of the interest that I have taken in the question of water power and the use of it.

I have sufficiently, I think, explained why I am here.

My impression is that there are three things in which this committee and the Congress and the country are especially concerned: First, and primarily—I think we ought to say primarily—is the improvement of the navigation of the Tennessee River; second, the use of the power that may be generated at Muscle Shoals; and, third, the nitrate products that might result from the location of plants at Muscle Shoals which are in construction at the present time. I do not believe that the Government can afford or would desire to abandon the enterprise at Muscle Shoals, because it has too much money invested there, and because of the fact that so much of benefit may come to the American people in the development of what has been undertaken.

It was suggested yesterday that you needed additional scientific information. About that I do not know. That is a matter for your committee to decide. But I do not know of any committee at any time that has apparently given more thoughtful, serious, and determined interest in an enterprise, than this committee has, to try to determine what should be done at Muscle Shoals. Personally—and I imagine that is the opinion of the committee—I believe that you are not interested in men; you are interested in achievement; you have no personal concern that anybody shall be accepted or rejected, but that this committee of the Congress is anxious to do that which is in the interest of the American people.

There is vast power at Muscle Shoals which should be utilized. I think all concede that fact. It is the duty of the Government, it would seem to me at the present time, to develop that power and to carry out, through some kind of means, the enterprise which it has begun. Whether it will do it as a Government enterprise, or whether it should be done as an individual enterprise under Government control is a matter to be determined by the committee. Personally, I do not believe that the American people would be content if this enterprise were abandoned. In the next place, I do not believe they would be content if it were turned over to private interests without Government control and Government supervision. Some kind of a scheme ought to be worked out, as I see it, that would give the Government control, would retain the ownership of the title to the property in itself, and that no scheme should be adopted that is not in the nature of a lease.

I examined with considerable interest the bill that was introduced by the chairman of this committee, and with many parts of it I am in full accord. I know of his conscientious endeavor, his devotion to his duty, and his painstaking efforts to accomplish results in the interest of the people; and there are other members of this committee who are equally interested, equally conscientious, equally devoted to the discharge of the obligation resting on them. Mr. Levering has developed a plan which he believes is practical and which he is fully satisfied can be carried out. Under that plan there is to be ownership in the Government; there is to be part control by the Government, and there is to be constant supervision by competent Government officials. In the bill which he will propose later he starts out with your bill, Mr. Chairman, and instead of providing that it shall be conducted by a board of directors of three he provides for a board of directors of seven, three of whom shall be officials of the Government, one of these directors to be selected by the Secretary of Agriculture, one by the Secretary of War, and one by the Secretary of the Treasury. The other four will be named by the stockholders of the corporation which he proposes, a corporation with capital stock of $5,000,000, $1,000,000 of which must be paid in cash within 30 days, and the other $4,000,000 of which must be paid in cash within 12 months. In addition to that, in order to protect the Government, he provides that this company shall give a bond for the faithful performance of the provisions of its agreement with the Government in

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the sum of $1,000,000, and that each one of the seven directors shall give a bond of $25,000 for the faithful performance of his duty as a director.

This bill places the control of the sale and distribution of nitrates in the hands of the three Government directors.

The general business of the corporation will be done by the seven directors, each having the same power.

The bill provides a salary for each of the directors of $12,000 per annum. The directors are limited to their salaries in emoluments.

The bill provides for a 50-year lease and payment to the Government annually of a sum which at the end of the 50 years will have fully paid every cent that the Government has expended on Muscle Shoals.

With reference to the power there is a provision which authorizes the Government to use that which will be necessary for its own uses and provides a limitation of cost.

The company will take charge of the construction, if the Government desires it, of the unfinished portions of the enterprise which were begun at Muscle Shoals, both for the generation of power and for the production of nitrates.

Now, Mr. Chairman, I have not gone into the details of this bill. It will be presented in regular form and you will want to examine it. I have only given you a general outline of the bill, and this bill is intended to safeguard the Government at every point and furnish, if the corporation is properly handled, a sufficient profit to satisfy investors to invest in the enterprise.

The bill provides that in the construction of the unfinished portions of the work, the work shall be done at a fixed sum on each of the enterprises, which sum is less than the estimates which have been made by the Government as to the cost of the completion of the dams and the nitrate plants.

Now, I believe that covers the proposition in a general way.

The CHAIRMAN. Have you a copy of the bill, Mr. Lloyd?

Mr. LLOYD. We have a copy of the bill, but it needs some little correction. In the first instances we prepared what would be a contract between the United States Government and the corporation, and then it was changed to the form of a bill, and in transcribing it portions of the contract are expressed in the terms of the contract rather than in the terms of the bill which would become a law, and those little changes, which are only small, we will fix up for you to-day.

The CHAIRMAN. Then you will hand it to the reporter and it can be printed in the hearings.

(The bill referred to is as follows:)

[S. 3585, Sixty-seventh Congress, second session.]

A BILL To provide for the manufacture of explosives for the use of the Army and Navy, to provide for the manufacture of fertilizer for agricultural purposes, to incorporate the Federal Chemical Corporation, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That there is hereby incorporated and created a corporation by the name, style, and title of the Federal Chemical Corporation (hereinafter referred to as the lessee). Said corporation shall exist and have succession for a period of fifty-five years after the passage of this act.

(1) To adopt, use, and alter a corporate seal;

(2) To sue and be sued and to complain and to defend in any court of law and equity within the United States;

(3) To make and enforce such contracts as may be necessary to carry out the provisions of this act;

(4) To appoint and fix the compensation of such employees, attorneys, and agents as are necessary for the transaction of the business of the corporation, to define their duties, require bonds of them, and fix the penalties thereof; but in no case shall any such employee receive a salary in excess of $12,00 per annum;

(5) To prescribe, amend, and repeal by-laws not inconsistent with this act for the conduct of its business; and

(6) To exercise all the rights, powers, and privileges conferred upon it by this act, and such additional powers, including the right of eminent domain for itself and the Government, as may be necessary to carry out the provisions of this act.

SEC. 2. That the business of said corporation shall be transacted by a board of seven directors (hereinafter called the board), one to be selected by the

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Secretary of the Treasury, one to be selected by the Secretary of War, and one to be selected by the Secretary of Agriculture. These three directors are hereinafter referred to as the Government directors, and are to hold office during the pleasure of the Secretary controlling the appointment. Any Government director may be removed from office at any time, either with or without cause, by the Secretary controlling the appointment.

SEC. c. That the Government directors shall have the same powers as the other directors of the corporation, and in addition thereto they shall control the sale and distribution of the nitrates, fertilizers, and other products of lessee: *Provided*, That they shall not have authority to bind their successors as to the sale or delivery of nitrates or other products manufactured by lessee for the Government except upon the written authority of the three Secretaries controlling their appointments.

SEC. 4. That when the flow of the Tennessee River at Dam No. 2 is less than 25,000 second-feet the Government directors shall have authority to regulate the amount of water used by lessee to generate power at Muscle Shoals so as to conserve the water and protect and regulate navigation.

SEC. 5. That the Government directors shall not own, control, or in any way be interested in the stocks, securities, or profits of the lessee or receive from it any commissions, extra compensation, or perquisite, or from any transaction in which it is a party, other than the salary provided by law.

SEC. 6. That the Government directors shall give their time, exclusive of all other business, to their duties as members of the board and as representatives of the department from which they received their appointment.

SEC. 7. That the four members of the board, other than the Government directors, shall be selected at the annual meeting of the stockholders of the corporation, as provided by the by-laws, and shall hold office for one year or until their successors have been elected and qualified: *Provided*, That any member of the board may be removed at any time by a concurrent resolution of Congress.

SEC. 8. That the board shall select one of its members as president. It shall select a secretary and a treasurer and as many assistant treasurers as it deems proper. The treasurer and assistant treasurers may be corporations or banking institutions and shall give such security for the safe-keeping of the moneys of the corporation as the board may require.

SEC. 9. That the power required to amortize the capital and make the payments to the Government by lessee and for the operation and maintenance of the plant shall be used or sold by lessee.

SEC. 10. That the board can not create or incur any indebtedness, liability, or expense against the Government unless authorized by an act of Congress.

SEC. 11. That each member of the board shall give a bond, to be approved by the Secretary of the Treasury, in the sum of $25,000 for the prompt and faithful performance of his official duties.

The salary of each member of the board shall be $1,000 per month, payable monthly, from the receipts of lessee as an operating charge unless changed by an act of Congress.

SEC. 12. That in the appointment of officials and the selection of employees for said corporation and in the promotion of any such employees or officials no political test or qualifications shall be permitted or given consideration, but all such appointments and promotions shall be given and made on the basis of merit and efficiency. The board shall give publicity to any request, coming from any source, asking for any favor in behalf of any person or the promotion of any employee. Any member of said board who permits the use of political or partisan influence in the selection of any employee, or in the promotion of any such employee of said corporation, or who gives any consideration to political considerations in the official action of said board, or who, knowing that such political influence has been or is attempted, does not give publicity to the same, shall be deemed guilty of a misdemeanor and upon conviction thereof shall be fined in a sum not exceeding $1,000 or be imprisoned not to exceed six months, or both such fine and imprisonment, and the conviction of any member of said board of the offense herein defined shall have the effect of removing such member from office.

SEC. 13. That the board shall make a full, complete, and detailed report of its operation as soon after the close of each calendar year as possible to the Congress of the United States. In addition to the report so made the Secretary of the Treasury shall, at least once each year, make a complete audit of all

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the accounts and all the financial operations of said corporation, and shall include in his annual report to Congress a detailed statement thereof.

SEC. 14. That the principal places of business of said corporation shall be established by the board at or near Muscle Shoals, Alabama, and the city of Washington, D. C.

SEC. 15. That the capital stock of the corporation shall be $5,000,000, divided into 50,000 shares of the par value of $100 per share, all of which must be subscribed before execution of the lease, and at least $1,000,000 of which must be paid in within thirty days thereafter, and the remaining $4,000,000 or such parts thereof as may be required to transact the business of the corporation and to enable it to comply with the terms of this contract, must be paid into the treasurer of the corporation upon thirty days' notice, to be given by the Government directors.

SEC. 16. That by authority of this act and the execution of a lease hereunder the lessee may, within thirty days after the passage of this act, lease from the Government all the property, real, personal, and mixed, now owned or that may hereafter be acquired by the Government in connection with or forming part of the Muscle Shoals project, or the possession, use, construction, maintenance, operation, or extension of that project, or any part or appurtenance thereof, including all rights the Government has or may acquire to the steam plant located at Gorgas, Alabama, on the Warrior River, together with the connecting transmission lines. Said property is included or intended to be included and described in the maps, deeds, descriptions, invoices, lists, and schedules furnished to the lessee by the Government, and when receipted for by the lessee shall be a part of its agreement and bind both parties as truly as if they were written herein, and which are hereinafter referred to as the "property."

SEC. 17. That the lease is to continue in full force for a period of fifty years from the date the lessee acquires possession of that portion of the property located at Muscle Shoals. The lessee shall return said property at the termination of this lease to the Government in good operating condition, subject only to such damage or loss as may have resulted without the fault, action, or neglect of the lessee.

SEC. 18. That the lessee shall, for and in consideration of the lease, construction, operation, rights, privileges, payments, and other considerations hereinafter mentioned or otherwise provided for in this act, construct all dams, power stations, and such other structures now under construction or agreed to be constructed by the lessee at Muscle Shoals, on the Tennessee River, in the State of Alabama.

SEC. 19. That the lessee must, within six months from the execution of the lease, submit plans and specifications for Dam Numbered Three, together with power station, locks or lifts, and other equipment, but will show an estimated increase of the primary hydroelectric power that could be generated under the present plans of Dam Numbered Two of not less than 30 per centum, and if such plans are approved by the engineer representing the Government, the lessee must build Dam Numbered Three, power station, and equipment, in accordance therewith, at actual cost without profit, or for a definite price of $25,000,000, as set out in section numbered 38 hereof.

SEC. 20. That should the plans of the lessee for Dam Numbered Three be rejected by the Government engineer, and the Government offer other plans in lieu thereof, the lessee must build Dam Numbered Three, power station, and equipment at actual cost and under all conditions of this act, and such plans will become a part of the lease and bind both parties as though such construction, agreement, and plans were set out in this act: *Provided*, That the cost of maintenance, repairs, and replacement will be paid by the Government and not become a liability of the lessee.

SEC. 21. That lessee must either construct Dam Numbered One or in lieu thereof open a navigation channel from the railroad bridge below Muscle Shoals up to the locks or lifts at Dam Numbered Two, the cost of which is included in the construction cost set forth in section 38 thereof.

SEC. 22. That the lessee must construct for the Government the locks or lifts for the purpose of maintaining navigation over the dams to be constructed under this act, the cost of which is set out in section 38 hereof.

SEC. 23. That should the Government acquire, by litigation or otherwise, all adverse interest in the Gorgas power plant, transmission lines, and coal mines, that lessee must pay a reasonable cost to be approved by the Government

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directors for not to exceed $5,000,000, unless by special agreement between the Government and the lessee acquiring the title, and the lessee must operate such plant as a part of the Muscle Shoals property included in this act, and repayment will be made by the Government to lessee at the termination of the lease of such amounts as lessee may have expended in acquiring such title.

SEC. 24. That the lessee must operate and maintain for the Government, and under the authority of the Government directors, the nitrate plants now, or which may hereafter become, a part of the property, and commence refitting them to make the required fertilizer compounds as soon as the plans for the work have been approved by the Government directors, and when they have been refitted to operate them as hereinafter provided.

SEC. 25. That the lessee will make such alterations, additions, or changes in the nitrate plants, or any part of the equipment or structures operated under the lease, as may be required to produce the nitrates or other compounds requested by the Government directors: *Provided*, That such changes can be made for a total expense of not more than $5 000,000, which amount is included in the construction cost set out in section 38 hereof. After the lessee has expended the $5,000,000 it shall make such additions or changes from time to time as may be necessary to produce the required nitrates and compounds requested by the Government directors, and such changes when made on request of the Government directors shall become an operating charge and payable from the funds on hand derived from the sale of nitrates and compounds and power not required to operate the plants.

SEC. 26. That the lessee must furnish the Government directors copies of the plans and specifications of the proposed changes to be made in the nitrate plants to fit them to produce the compounds or other products required by the Government. Such alterations are to be so designed that the nitrate plants can be refitted to produce explosive compounds with the least delay and expense.

SEC. 27. That the lessee must maintain and operate a research department in cooperation with the Agricultural and War Departments of the Government for the purpose of developing the processes for the fixation of atmospheric nitrogen and the manufacture of such fertilizer or other compounds as may be required by the departments of Agriculture and War, the cost of research work to be charged to operating expenses of the plant.

SEC. 28. That said lessee must begin construction within sixty days from the time it is given possession of that portion of the property located at Muscle Shoals and to continue such construction in a diligent, businesslike, and workmanlike manner until the construction work provided for under this contract shall be completed according to terms hereinafter set forth, within the time prescribed in section 38 hereof.

SEC. 29. That if at any time during the construction, in the opinion of either the lessee or the Government engineers, any of the structures provided for in the plans have become, or are liable to become, weak, dangerous, uncertain, or inefficient, or their efficiency or utility may be increased, they may request changes, extensions, or additions to be made in the plans for the purpose of increasing the strength, stability, duty, endurance, or efficiency or usefulness of the dams, locks, power stations, or other structures to be built by lessee under provisions of the contract, such changes, extensions, or additions shall be submitted to the engineer representing the other party and to the surety companies furnishing the bond of the lessee and other constructors, and if such changes, extensions, or additions shall be approved by the engineer representing the other party and the surety companies, they are to become a part of the construction contract and binding on both parties and the surety companies as if originally written therein, but in no case shall such changes, extensions, or additions, when they have been approved by the Government, lessee, and the surety companies, add to the cost of the work or in any way change the dates and amount of payments provided for in this act.

SEC. 30. That should the request for changes, extensions, or additions in the plans for any of the purposes set forth in the foregoing section of this act have been approved by the surety on the bond of the lessee and other contractors, and not been approved by the engineers representing both the Government and lessee, then the questions of endurance or strength of such material or members as can be determined by physical test shall be submitted to the United States Bureau of Standards for final determination, and all questions as to the effect of the proposed changes, extensions, or additions upon the increase of strength, stability, duty, endurance, or efficiency of the dams, locks, power stations, or other structures to be built under the contract; also

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the plans and specifications for the changes as requested shall be submitted to the engineering faculty of one or both of the following-named universities or schools of technology; Massachusetts Institute of Technology, Cambridge, Massachusetts; Cornell University, Ithaca, New York; and the report of such faculty or faculties, if submitted to more than one, together with the report of the Bureau of Standards, shall be final, and if such report of the Bureau of Standards and faculties of technical schools mentioned herein show that the proposed changes, extensions, or additions will materially increase the strength, stability, duty, endurance, or efficiency of the structure affected by the changes, extensions, or additions, then such changes, extensions, or additions shall become a part of the working plans of the contract, the same as if they were originally written therein or had been approved by the engineers of both parties and the surety companies without increasing the contract cost.

SEC. 31. That the cost of testing, consulting, or other expenses caused by the request for changes in the plans, as provided for in this act, shall be borne by the party making the request.

SEC. 32. That during the time of construction the Government and the lessee shall each designate an engineer to represent it on the work, and the acts of such engineer shall be binding as to the party designating him as a representative.

SEC. 33. That the lessee shall not be required to expend in the manufacture of nitrates or other fertilizer compounds or other products any money other than that received from the sale of the products of the nitrate plants, plus the amount received from the sale of power in excess of that required to operate the plant.

SEC. 34. That the lessee shall sell fertilizer compounds produced by the plant at the price and terms that may be fixed by the Government directors.

SEC. 35. That should the development of power for use and sale from this plant, together with the receipts from the sale of its products, be insufficient to produce the amount of fertilizer compounds or other products requested by the Government, necessary to meet its requirements, the lessee agrees to construct under special contract other power plants upon sites owned by the Government and selected by the Secretaries of War and Agriculture and itself, said plants to be construed and operated under the general terms of this act for the purpose of enabling the lessee to comply with the Government requests. And the authority of the contract shall include all such sites but shall not require the Government to incur any further liability or expense.

SEC. 36. That all investments made by the lessee for the purpose of complying with the requirements of this act, and the protection and maintenance of the property, excepting the construction work set out in paragraph 18 of this contract, or other work specially contracted for, shall, unless otherwise provided, become the property of the Government at the expiration of the lease upon paying the lessee the amount invested.

SEC. 37. That the lessee shall have the right to place any desired improvements on the leased property for its own use and at the expiration of the lease the Government will either purchase such improvements at the actual value or allow the lessee to remove the same.

SEC. 38. That the lessee shall build Dam Numbered One, or in lieu thereof to open a channel for navigation from the railroad bridge below Muscle Shoals to the locks or lifts at Dam Numbered Two, for the sum of $4,000,000.

The lessee shall complete and equip Dam Numbered Two ready to generate, in conjunction with Dam Numbered Three, not less than six hundred thousand horsepower for $23,000,000.

The lessee shall build Dam Numbered Three as set out herein for $25,000,000.

The lessee shall build the locks or lifts to maintain navigation over the dams for $3,000,000.

The lessee shall reconstruct and extend the nitrate plants not to exceed in expense the sum of $5,000,000.

SEC. 39. That the construction by the lessee, authorized by this act, shall commence within sixty days after it is given possession of the property located at Muscle Shoals and it shall continue such work in a diligent, business, and workman like manner until the construction work provided for under this act is completed, as herein set forth. Within two years the hydroelectric plant shall be equipped and ready to generate one hundred thousand horsepower. And within three years from date of possession by the lessee the plant shall be equipped and ready to generate two hundred thousand horsepower; and within five years from date of possession by the lessee the plant shall be

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ready to generate six hundred thousand horsepower, and the construction shall be complete in all details as set forth and described in the plans and specifications which are a part of the contract between the Government and lessee.

SEC. 40. That the lessee shall purchase, at a total cost of not more than $5,000,000, the title or easements to the land that will be submerged or flooded by the construction of the dams mentioned in this act. All such expenditures shall be approved by the Government directors and shall be repaid to the lessee at the termination of the lease authorized by this act.

SEC. 41. That whenever nitrates can be made at a profit, or when the cost of the same has been so reduced that the funds arising from the sale of excess power and fertilizer compounds or other products are not needed in whole or in part for financing such productions as herein provided, or upon request of the Govenment directors, the said funds, or any part thereof, shall be paid by the lessee into the Treasury of the United States.

SEC. 42. That the engineer representing the Government shall on the first of each month give the lessee an estimate of the work performed, material furnished, and expenditure authorized by the contract and a statement of the amount earned by it during the preceding month and the amount due lessee from the Government.

SEC. 43. That payments under the contract authorized by the act are to be made monthly in cash by the Government unless it should issue bonds for the construction work. Then the lessee will receive such bonds, including accrued interest, in payment for any of the obligations incurred by operation of the contract in lieu of cash at the market value at the option of the Government.

SEC. 44. That all stores, supplies, equipment, and loose personal and floating property, including all engineers' supplies, instruments, and files, now on or about the premises shall be included in the lease.

SEC. 45. That the lessee shall have the right to sell or exchange at its discretion all worn, useless, or excess personal property and shall use the proceeds to purchase other supplies required to operate the plant or for such other purposes as may be approved by the Government directors, and will, at the termination of the lease, deliver to the Government all property on hand which may be needed to operate the plant.

SEC. 46. That the lessee shall retain the proceeds received from the sale of power not required for Government use, and the tolls received from the Government for power consumed by it in excess of eight hundred and seventy-six million horsepower hours during any one calendar year, exclusive of the power required to operate the locks or lifts. One-half of the net receipts received by the lessee in excess of $250,000 from the sale of power or tolls from the Government or other sources during any one year shall be used to finance the production of compounds or other products, or paid into the United States Treasury, as requested by the Government directors.

SEC. 47. That lessee shall operate and maintain the hydroelectric and steam plants for the compensation set forth in this act, except the cost of fuel, which shall be charged against the sale of power, and is to be paid by the consumers of power in proportion to the amount used.

SEC. 48. That should the Government require more than one hundred thousand horsepower exclusive of the power to operate the locks or lifts, it will, unless in times of emergency, give the lessee six months' notice to furnish the estimated increase of power, provided it can be furnished without interfering with any valid contracts for the sale of power. The lessee shall receive 1 mill per kilowatt hour for the extra power so furnished, which shall be full compensation for all loss or damage sustained by the lessee by reason of the diversion of the power to the use of the Government. And the lessee shall continue to operate the property at its own expense exclusive of the cost of fuel.

SEC. 49. That all necessary expenses, including reasonable attorneys' fees, incurred by the Government and required to perfect and enforce its rights to the possession and enjoyment of any portion of the property included or intended to be included in the lease authorized by this act, or in acquiring land for the development or operation of the property, shall be charged to the construction account of the project, and not to be included in the construction cost set out in section 38 of this act.

SEC. 50. That the lessee shall place the property, or any part thereof, at the disposal of the Government in the event of war or any other public emergency, and during the period the plant is not operated by the lessee the proceeds from the sale of excess power to be paid into the United States Treasury.

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SEC. 51. That after the completion of Dam Numbered Three in accordance with plans that have been approved by the lessee, it will sell or use not less than two hundred and fifty thousand horsepower of primary power, and at an average of 2 mills per horsepower hour.

SEC. 52. That the lessee shall give to the Government for its protection a good and sufficient surety bond in the sum of $1,000,000, to be approved by the Secretary of the Treasury, for the faithful performance of the provisions of the lease authorized in this act, and which shall be renewed every five years. In event the bond is not renewed at the expiration of any five-year period, or for any other reason becomes uncertain or inefficient, and the lessee fails to renew the security after ninety days' notice, then this lease shall terminate and the Government may take possession of the property without further notice or delay: *Provided further*, That the lessee may deposit with the Treasury of the United States cash or Government bonds of the market value of $1,000,000 in lieu of a surety bond.

SEC. 53. That should the lessee operate other dams or storage reservoirs than those included in the lease, the waters of which will discharge into the Tennessee River above the dams of the Muscle Shoals project, it will have the right during the period of the lease to pass such discharge waters through the power stations of the Government plant upon payment of one-half mill per kilowatt hour for the power so generated: *Provided*, That such use will not hinder or reduce the capacity of the hydroelectric-power stations.

SEC. 54. That the Government experts, inspectors, and accountants can at all reasonable times examine the books, papers, accounts, meters, and such other accessories of the plant necessary to satisfy them whether or not the lessee is executing the lease in good faith and capacity.

SEC. 55. That any time after five years from the date of possession by lessee the Government may, after giving six months' notice to the lessee of its intention, terminate this lease upon the same terms and conditions as if it had expired by limitation, and in addition thereto pay the lessee the sum of $50,000 for each year of the unexpired term of the lease.

SEC. 56. That the lessee shall not, in whole or in part, sell, transfer, sublet, or delegate its rights, interests, or authority in this lease except to the Government.

SEC. 57. That the lessee shall use or sell all primary power that can be generated by the hydroelectric plants, supplemented by a reasonable use of the steam plants, and now or hereafter included in the lease, in excess of the one hundred thousand horsepower required to operate the plant, such use or sale to be under the terms and for the period of the lease.

SEC. 58. That should the present foundation of Dam Numbered Two be found defective or show excessive leakage during the five years succeeding the execution of the lease, the Government will pay to the lessee the expense of the necessary repairs, including a reasonable allowance for overhead.

Senator HEFLIN. Who is to be the head of your corporation, Mr. Lloyd?

Mr. LLOYD. I don't know. I explained at the outset that I had no personal knowledge of anything, or of any interest, because I was not connected with any interest, and I do not appear here for anybody, and if I did appear for anybody, or if it appeared that I did, it would be for Mr. Levering, and I explained in the outset, before you came in, Senator Heflin, how I happened to come in contact with him.

I have no employment as attorney at all, and no prospect of employment, and no prospect of compensation in any way, so far as I know.

Senator HEFLIN. What is this offer? What does the offer that you provide for amount to in dollars for the use of the——

Mr. LLOYD (interposing). The construction cost is $60,000,000, including everything; including the plants and dams.

Senator HEFLIN. You provide that the Government should furnish that $60,000,000?

Mr. LLOYD. We provide that the Government shall furnish the $60,000,000; yes, sir.

Senator HEFLIN. After that is done, what does this offer that you provide for amount to in dollars for the use of this property that should be leased to this corporation?

Mr. LLOYD. Well, it will amount to something like $3,000,000 a year.

Senator CARAWAY. Mr. Lloyd, if Congress were to hold up this enterprise, pass this act, what assurances have we that anybody financially responsible would come forward and take up this proposition?

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Mr. LLOYD. As far I am individually concerned, I said at the outset that I had none. You may find out from Mr. Levering. He may know, and I rather suspect he does, but he has not revealed it to me. I don't know who it is.

Senator CARAWAY. This does not amount, then, to one of the measures that is designed to delay final action?

Mr. LLOYD. No. There is no intention to delay immediate action.

Senator CARAWAY. I am not accusing you of having any such intention, but will not that be the effect?

Mr. LLOYD. No; I think not. I feel very sure that this can be carried out and that the money will be forthcoming to purchase the stock.

Senator CARAWAY. Personally, I have been of the opinion all the time that all these many offers were brought forward by people to delay final action.

Mr. LLOYD. I want it distinctly understood that I have no such intention.

Senator CARAWAY. I do not accuse you of it, but I think the facts are that a great many of these propositions are put forward with the idea of preventing final action.

Mr. LLOYD. Senator, if I thought that Mr. Levering was undertaking to defeat or delay, I would have nothing to do with this matter at all.

Senator CARAWAY. Oh, I am sure of that; but what impresses me is that nobody ever made a suggestion of the use of this until now there is some chance of doing something with it, and everybody brings forward a new plan and a new bidder; which has raised in my mind, I am frank to say, and I think everybody with whom I have discussed it believes that back of it all in some way or other there is an influence that does not want it developed.

Mr. LLOYD. That may be. I do not question that. I do not know whether that is true or not, but I would suppose that it is true that each of you realizes that this is a very important matter and you want to get all the light you can.

Senator CARAWAY. Oh, yes, sir.

Mr. LLOYD. Any information that can come to you, if it is beneficial, in the way of suggestion, you would be glad to have. That is the interest I have in it as an individual. I am anxious to see something done that brings about the results and accomplishes the benefits which I mentioned before you came in. We are interested in three things: Navigation of the Tennessee River, the development of power, and the furnishing of nitrates in time of war to the Government and in time of peace to the people in different localities.

Senator CARAWAY. Oh, yes. Agriculture in certain sections of this country is going to perish if we do not do something.

Mr. LLOYD. I am exceedingly anxious about the nitrate proposition, and as an individual I am frank to say to you that I am more concerned in the nitrate situation and its fertilizer use by the farmers of the country than I am in any other end of the business.

Senator CARAWAY. So am I; and I, having seen things like the Panama Canal, for instance, held up almost half a century by interests that never did disclose their real purpose, have an impression that that is likely to be the case here.

Mr. LLOYD. There is some truth in that, because I know something about that legislation. I remember very well how long and how faithfully the Senator from Alabama worked.

Senator HEFLIN. Senator Morgan.

Mr. LLOYD. There is no man, I think, that deserves, from a statesmanship standpoint, a better monument than Senator Morgan for his splendid efforts to bring about the construction of the Nicaraguan Canal—not the Panama Canal.

Senator CARAWAY. Which resulted in this Panama Canal that we got.

The CHAIRMAN. While he labored very faithfully, he failed in getting, in the end, what he thought we ought to have.

Senator HEFLIN. That is exactly what he wanted, but his efforts resulted in having this canal constructed.

Senator CARAWAY. I think we are traveling in the same old channel.

Mr. LLOYD. Oh, I am not so sure, Senator. I was on the ground at the time. I am not so sure but what the Nicaraguan Canal would have been talked about yet if it had not been for the extraordinary efforts that were made by the then President taking the matter in his own hands.

Senator CARAWAY. I am satisfied if we had just let the people who were objecting to any construction except in their way continue we would have been arguing it to-day and twenty-five years from now; and the fertilizer trust will be presenting to us arguments why this Muscle Shoals ought not to be improved except this way or that way, and there will be forty different ways.

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Mr. LLOYD. I think you will find that now. I think you will find some people who will say that is not the place for a nitrate plant. You have heard that, I think, intimated before the committee.

Senator HEFLIN. And I don't think there is a more desirable place in the world.

Senator CARAWAY. I know nothing against it except it is in Alabama.

Senator HEFLIN. Probably he thinks if it was in Arkansas it would be better.

Mr. LLOYD. What I would like to see, and which would settle the difference between these two Senators across the table would be its location out in Missouri.

Senator HEFLIN. You do not provide anywhere in your contract for the manufacture of fertilizers?

Mr. LLOYD. Oh, yes. I mentioned that; but when the bill is submitted, you will then see just what the bill proposes.

Senator HEFLIN. You mean that will be set out in the contract? You just state now what you are willing to do?

Mr. LLOYD. Yes, sir.

Senator HEFLIN. Well, that is the way Mr. Ford has done. Of course, they say here frequently that he does not say here what he will do, but he states what he is willing to do, and the contract itself will state what he has to do.

Senator CARAWAY. I was impressed with one feature of your bill—the salaries of it and the fact that they are limited.

Mr. LLOYD. The salaries are paid by the lessees.

Senator CARAWAY. Yes; I know they are, and they are limited.

Mr. LLOYD. You mean by that they are not excessive?

Senator CARAWAY. I would not say that. It has got so that anybody who is hired by the Government must have more than others.

Mr. LLOYD. It seems to me in the light of modern development that Congress would think a $12,000 salary is a very modest one.

Senator NORBECK. It is hard for us Senators to admit that anybody should have any more salary than we have. We are prone to measure it by our own.

Mr. LLOYD. As far as I am concerned on that proposition, as far as I am concerned as a citizen and knowing something about what you people have to pass through, I would change the salary of every Senator and Member of the House to at least $12,000.

Senator CARAWAY. I reckon you would change most of them before you would change their salaries.

Mr. LLOYD. No, sir; I am not so sure I would. It may be, now that we are going into an economical period, it might cause trouble, but I was in the House when we changed the salary from $5,000 to $7,500, and it was understood at that time that the men who voted for the additional increase of $5,000 to $7,500 would stay at home; and if there was any man who stayed at home on account of the increase of salary I do not know who he is.

Senator CARAWAY. That is not what I said.

The CHAIRMAN. All right. If that is all we are very much obliged to you, Mr. Loyd.

(Whereupon, at 1 o'clock p. m., the committee adjourned until to-morrow, Thursday, May 11, 1922, at 10.30 o'clock a. m.)

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MUSCLE SHOALS.

THURSDAY, MAY 11, 1922.

UNITED STATES SENATE,
COMMITTEE ON AGRICULTURE AND FORESTRY,
Washington, D. C.

The committee met, pursuant to adjournment, at 10.30 o'clock a. m., in the hearing room of the Committee on Commerce, United States Senate, Capitol Building, Senator George W. Norris, presiding.

Present: Senators Norris (chairman), Keyes, Norbeck, McKinley, Kendrick, Harrison, and Heflin.

The CHAIRMAN. The committee will come to order, gentlemen. Mr. Marsh is here, and I believe he was to be heard this morning.

STATEMENT OF MR. BENJAMIN C. MARSH, MANAGING DIRECTOR FARMERS' NATIONAL COUNCIL, BLISS BUILDING, WASHINGTON, D. C.

The CHAIRMAN. You may proceed, Mr. Marsh.

Mr. MARSH. For the record, my name is Benjamin C. Marsh, and I appear as managing director of the Farmers' National Council, with headquarters in the Bliss Building, here in Washington.

Mr. Chairman and gentlemen of the committee, I confess that I am not an expert on fertilizer manufacture or anything of that sort, but the issues involved in this bill are very important. The manufacture of fertilizer is solely an incident; it is almost a negligible incident.

Senator KEYES. You spoke of "this bill." What bill do you refer to?

Mr. MARSH. The Ford proposal.

Senator KEYES. All right.

Mr. MARSH. I should have said, perhaps, Mr. Ford's contract.

The CHAIRMAN. Mr. Marsh, we have before us the bid of Mr. Ford, the bid of the Alabama Power Co., the bid of Mr. Parsons and the bid of Mr. Engstrum, and the bill that I have introduced. All of those things are pending before the committee in these hearings, and we will be very glad to hear you on any one of them or on all of them.

Mr. MARSH. I appreciate your setting me right, sir. I thought it was particularly Mr. Ford's proposition that you were discussing.

The CHAIRMAN. Well, there has been a great deal said about Mr. Ford's bid, of course, but that is not the only thing that we are considering here.

Mr. MARSH. I shall not attempt to analyze the others, but I shall analyze Mr. Ford's bid. Really, the most important thing involved is what the nation is going to do with its water power. That is one of our great natural resources.

Let me state that the Farmers' National Council indorsed the plan before Congress a year and a half or so ago, to have the Government develop water power at the Muscle Shoals project, and also, as an incident thereof, to manufacture fertilizer.

The CHAIRMAN. Those organizations then were in harmony at that time with the other farm organizations?

Mr. MARSH. We were entirely in harmony with them, and much in advance of them in our viewpoint on the question of natural resources. We regarded that as one of the methods of securing at least partial conservation of our natural resources. We based our position on the fact that the council, which is a special union of national and State farm organizations to carry out a legislative program, at its meeting here in Washington in January, 1919, adopted

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the following plank on natural resources which, with your permission, I would like to read, as it is brief.

The CHAIRMAN. All right.

Mr. MARSH. It is as follows:

"NATURAL RESOURCES.

"The natural resources of the country, now in public ownership—coal, iron and copper ores, water power, timber lands, phosphate deposits, po ash, gas, oil, etc.—are worth hundreds of millions of dollars. It is a solemn obligation devolving upon the country not to alienate any more of these natural resources either by patent or by lease, but to develop and hold them in trust for this and succeeding generations. Such of these natural resources as are now in private ownership should be acquired by the government at the earliest possible opportunity, payment to be only for actual and prudent investment."

We were very conservative in estimating the natural resources still in public ownership at hundreds of millions of dollars. I think, if we had put it at scores of billions we would probably be more nearly accurate.

Now, I simply want to say a few things, or quote a few statements, rather, from a very eminent conservationist, Dr. Charles R. Van Hise, who, almost up to his death, a year or so ago, was president of the University of Wisconsin at Madison. Doctor Van Hise, in his book on The Conservation of Natural Resources in the United States discusses the control of water powers, which, of course, is vitally connected with this bill, and directly connected with it.

I would like to quote just a few of his statements. He says:

"Water powers should be controlled by the public"——

The CHAIRMAN: Give the page there.

Mr. MARSH. Page 133.

"Water powers should be controlled by the public; I do not say owned or operated by the public. The elastic word 'controlled' is used because the amount of control which is advisable or necessary is different in different cases. The North American Conservation Conference of 1909, composed of commissioners from the United States, Mexico, Canada, and Newfoundland, agreed unanimously upon the principles which should obtain as to the control of water powers. Therefore these principles may very well serve as a starting point in the discussion of the subject. 'We regard the monopoly of waters,' said the commissioners, 'and especially the monopoly of water power as peculiarly threatening. No rights to the use of water powers in streams should hereafter be granted in perpetuity. Each grant should be conditioned upon the prompt development, continued beneficial use, and the payment of proper compensation to the public for the rights enjoyed; and should be for a definite period only. Such powers should be no longer than is required for reasonable safety of investment. The public authority should retain the right to readjust at stated periods the compensation to the public and to regulate the rates charged to the end that undue profit or extortion may be prevented.'"

I will not read the whole of that.

Senator MCKINLEY. Mr. Marsh, do I understand that you indorse that?

Mr. MARSH. I indorse the principle that there should be at least control, and I would like to point out that, it seems to me, under Mr. Ford's offer there is not adequate control, and I am opposing that offer of Mr. Ford's on that score. I urge very strongly that the Government should retain all these water powers and the plants constructed there and develop water power itself. I will develop my reasons for that a little later, Senator McKinley. I am glad you raised the question.

I have seen all of these other bills, but I have not studied them as carefully as I have Mr. Ford's, believing that Mr. Ford is the one that had the chief consideration of this committee. None of these bids, if generally applicable, protect the public adequately, it seems to me.

This book, I might state, was published in 1912, and I remember that Colonel Roosevelt had Doctor Van Hise down to see him at Oyster Bay shortly after this book came out and they discussed the whole program of conversation together.

Senator MCKINLEY. Do you feel that the Federal water power act protects the public, Mr. Marsh?

Mr. MARSH. No; I do not think it does. I think we have to get control of the water powers of the Nation and they have to be developed absolutely for service and there must not be any private profit in the development of any of them.

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because our coal and oil are going, and our water power in a large measure has to be relied upon in the future as motive power, and very cheap motive power. Of course, it is not universally available. We have some coal left, but, nevertheless, water power is, in a large measure, a continuing and more nearly inexhaustible natural resource than either of the others. Our oil is rapidly disappearing.

Senator McKINLEY. Then, you would think it wrong to tie it up in anyone's hands for 100 years?

Mr. MARSH. Yes. The Farmers' National Council, in the meeting that we held here when this so-called agricultural conference was held in Washington last January, indorsed only the general principles of the Ford plan as an effort to get cheap fertilizer. We did not indorse the details of it. I was unable to get a copy of the contract until recently, and I think very few farmers have seen the contract.

The CHAIRMAN. You are now speaking of Mr. Ford's bid?

Mr. MARSH. Yes; Mr. Ford's contract or bid.

The CHAIRMAN. Yes.

Mr. MARSH. Mr. Ford's proposal.

The CHAIRMAN. Yes; we just want to understand which offer you are speaking of.

Mr. MARSH. Very few farmers have read it, and very few farmers have had the time to analyze it carefully, and I am going to take up later, with your permission, my reasons for thinking it will not assure cheap fertilizer, and I shall quote from the report of the Federal Trade Commission on the fertilizer industry situation. Needless to say, we want cheap fertilizer for the farmers. That is unquestionably an essential thing. Let me read further from Doctor Van Hise's book, on page 135:

"First. Public control is necessary to secure reasonable charges.

"Herbert Knox Smith, commissioner of corporations, states that already a large proportion of the water powers, especially the best and largest ones, are owned by a few corporations. He says that the General Electric Co. controls at least 250,000 horsepower and partly controls 420,000 more; that the Westinghouse Co. controls absolutely 180,000 horsepower and partly controls 100,000 additional; that 11 other companies control 875,000 horsepower—making a total in the control of 13 companies of 1,825,000 horsepower, or more than one-third of the entire development of the United States. Not only do these companies control adjacent powers, but by a system of coupling up they obtain a high state of efficiency. Since it is advantageous to have the power uniformly used and the call for the maximum amount of power occurs at different times in different places, by coupling up a large number of plants a much higher average use of the power is possible than if each plant were separately operated. This concentration is economically advantageous. Therefore, conservation requires us to encourage concentration and coupling in order that we may get the greatest efficiency of the water; but if we permit this, the users can only be protected by public control. Hence the conservation principles with reference to water powers are concentration and public control."

I might insert also that Doctor Van Hise's book on Concentration and Public Control, published, if my memory serves me right, three or four yars after this book, The Conservation of Natural Resources of the United States, was published, discusses very thoroughly Federal control over these water-power companies and corporations doing an interstate business.

Continuing on page 136, Doctor Van Hise says:

"Also Herring says in reference to California—this is a quotation from Application of Water Power, by W. E. Herring—'on four of the rivers in northern California, where there is a possible development of over 800,000 horsepower, only 20,000 has been actually utilized, while speculative water rights are held on these streams from which over 566,000 horsepower could be developed; or, in other words, 75 per cent of the power possibilities on these streams have been alienated from public ownership and less than 2 per cent utilized for useful purposes.'"

In this connection I would like to say that I have not the details here, as I overlooked to bring with me a short description of the great campaign that is now on in California, which was explained to me by Mr. William Kent when I was out there last fall. Mr. Kent, Mr. Spreckels, the labor organizations, and the progressive farm organizations are all backing the movement to have the State invest hundreds of millions of dollars in retaining control and developing their own water power out there, as an asset which they should not permit to

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be alienated at all from the State, and which should be developed, in their judgment, for the advantage of the entire public.

Continuing Doctor Van Hise's own statement, not that of Mr. Herring—and this is my last quotation:

"Therefore the economic advantage which comes from large holdings and from coupling, combined with the fact that monopoly of water power does already exist in various parts of the country, and is likely to exist elsewhere in the near future, make it absolutely necessary for the public to control the prices which may be charged for water power. The companies must not be allowed to decide the rates which they levy. If this be done extortion will be practiced."

Now, the question came up in connection with your hearings previously on all of these proposals with reference to Muscle Shoals as to whether or not the Government should control the prices of products of factories which might use any of the water power developed under Mr. Ford's proposal, assuming that it is adopted. It would seem to me that there are two distinct propositions there. It would seem to be the function of the Government, under a public commission—and when I speak of the Government I mean the Federal Government—to control the charges for motive power to be supplied by this natural resource, by this water power, but that commission could not go into the extremely complex and somewhat difficult task of controlling the charges of a hundred or five hundred or a thousand different kinds of manufacturing concerns using this water power.

You will remember that Mr. Herbert Knox Smith, when Commissioner of Corporations, advocated something which the Federal Trade Commission has advocated since—that is, the principles of what is known as the Steele bill, now before the House, should be adopted in reference to these corporations engaged in interstate commerce. It would permit them to take out an elective license. If they elect to take out a license from the Federal Trade Commission—corporation engaged in interstate commerce—and complied with the regulations and requirements of the Federal Trade Commission, they are not subject to prosecution under the Federal antitrust law. If they decline to avail themselves of the opportunity to take out such an elective license, then they are subject to prosecution. Of course that is another proposition, but I do not think it is fair to say that because the Federal Government would not control the charges which are made for electrical power or for shoes manufactured by a factory the machinery of which was driven by power derived from one of these federally operated electric power plants that the system is not sound.

The Federal Government has to retain those natural resources, and its responsibility as to these resources ends when it assures equal access at reasonable rates to the power generated through these natural resources by the Government.

Now, taking up Mr. Ford's proposal, I do not want to be understood as in any way invidiously criticizing Mr. Ford, but I can not help thinking of what my old college professor told me out in Grinnell, Iowa, when I was a junior in college. It is something I have never forgotten. He said to our class one day, "A benevolent despot is the most dangerous of despots; he is absolutely honest, and you forget to watch him."

Now, Mr. Ford is absolutely honest. I have studied Sir Conan Doyle's works and articles on spiritism, and I can not believe that Mr. Ford, after he has passed hence, can, 20 years from now, say, from the spirit world exercise any control over this corporation which is to be created. I have no doubt he would like to do it, and I can conceive that the American Farm Bureau Federation, which is so far removed from contact with the real farmers of America, might construe it that he would have that supernatural ability; but the ordinary farmer, who gets up in the morning and dresses himself and has to make his own living, will not accept that theory. They know that a corporation is a corporation, and while we believe in the transmission of traits and are willing to assume that Edsol Ford has inherited all of the splendid principles of his father, it is the question of principle that is involved; and I will say right here that the best investment that the water-power companies of America could make would be to pay a million dollars a year to any farm organization to smash and defeat the conservation policy by establishing a precedent such as would be established in this offer of Mr. Ford's, if accepted. Mr. Ford has not done it for that purpose: I concede that very frankly. But let me go through this with you a little, if I may. I will not take time to go into all of it.

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I understand, too, that the Military Affairs Committee of the House has a series of subcommittees going over each of these sections, and it probably will not be quite the same as this when it comes out.

Section 1 reads:

"For the purposes of carrying out the terms of this agreement, the undersigned will form a corporation (hereinafter referred to as the company) with a paid capital stock of not less than $10,000,000"—

And that last clause, "with a paid capital stock of not less than $10,000,000," is inserted in typewriting, while the rest of it is printed.

"* * * to be controlled by the undersigned, which company will immediately enter into and execute all necessary or appropriate instruments of contract to effectuate this agreement."

Then, section 2 reads:

"The company shall complete for the United States the construction work on Dam No. 2, its locks, power house, and all necessary equipment, all in accordance with the plans and specifications prepared or to be prepared or approved by the Chief of Engineers, United States Army, and progressively install the hydroelectric equipment in said power house adequate for generating approximately 600,000 horsepower, all the work aforesaid to be performed as speedily as possible at actual cost and without profit to the company; it being understood that the necessary lands and flowage rights, including lands for railway and terminal connections, have been or will be acquired by the United States."

In other words, it looks to me as though we were sort of giving him a gift of 600,000 horsepower here.

I would like to say right here that I would like to know whether the Farm Bureau proposed this to Mr. Ford or whether Mr. Ford proposed this to the Farm Bureau? That is a question which I think could be answered.

I know this, that Mr. R. F. Bower has been working very hard on the Ford proposal; and I like Mr. Bower personally very much, but he has been a lobbyist for water-power companies. I think he was connected with some fertilizer companies. If I am not correct in that you can correct me, but it is nothing in derogation of a man's character to be working for some fertilizer companies at all. He ought to know a whole lot more about the fertilizer business than I do, but I will bring that up a little later in criticizing this paragraph.

Senator HEFLIN. He impressed this committee as knowing a whole lot about it, or at least he so impressed me.

Mr. MARSH. He does know a whole lot about it, unquestionably. Therefore I am rather surprised at the position he takes. If he did not know anything about it I could understand some of his statements, but he says he is an expert.

I need hardly remind you that the American Farm Bureau Federation indorsed the Cummins-Esch law, which has robbed the farmers of $750,000,000 a year, and now they are getting all het up, so that they have to refresh themselves with an ice box, over a saving to the farmers of 10 or 15 million dollars a year, possibly 25, in fertilizers, while they let Wall Street rob them of $750,000,000 a year under the Cummins-Esch law.

Senator HEFLIN. I am glad you mentioned that, because I see there are others that think Wall Street is working on the people constantly as well as I do.

Mr. MARSH. Yes, sir. Wall Street is in that respect like the Lord—it never slumbereth or sleepeth.

Senator MCKINLEY. Is there anything to indicate——

Mr. MARSH. And let me add that it is the only respect in which it is like the Lord.

Senator MCKINLEY. Do you think there will be anything in the course of the next 5 or 10 or 20 years to prevent Wall Street from getting possession of $10,000,000 of stock of this company and control it?

Mr. MARSH. Frankly, I can not see that there is. It would not be possible during the lifetime of Mr. Ford.

Senator MCKINLEY. I do not think so either. I think he is absolutely honest.

Mr. MARSH. Yes; I think so, too; but we have to recognize that 10 years is a short time in the life of a corporation, and we are dealing with the principles involved. A great effort is being made by these financial institutions to secure control of our natural resources. They have frittered away and wasted the coal and oil. They have made hundreds of millions of dollars without any corresponding or commensurate reduction in price to the users. They see those natural resources are going—particularly the oil. Of the coal, we have enough to last for years and years; but they see, too, that if they can get access on

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a hundred-year basis—and that is not all; this is not a hundred-year contract, and I will read you another paragraph to show you what is involved in this—they see that you are abolishing the program of conservation for which all of the intelligent, 100 per cent Americans of this Nation have been working, and you are substituting therefor a precedent for dissipating all of our natural resources.

Senator McKINLEY. In speaking of oil, Mr. Marsh, is it not a fact that frequently disinterested men, men who have no idea of any connection with the Standard Oil Co. getting control of anything, organizing a company, and in the course of a few years something happens to them, and the stock of this company turns up in the control of the Standard Oil Co.?

Mr. MARSH. Yes; because, as Doctor Van Hise has put it, you have got to have concentration; you have to have monopoly in the development of most of these resources, to assure efficient and economical management. One great evil of our coal industry to-day is that it is utterly chaotic. It is not the fault of any one individual. I blame the coal operators not so much for the present condition of the coal industry as for the fact that they are fighting desperately in an effort to prevent the establishment of order and real business efficiency in the development of the coal industry. Of course, admittedly, they have done a lot of wicked things.

If the American Farm Bureau Federation were interested in the conservation of natural resources, I fail to see why it should not indorse the Kenyon-Newton coal bill, which, for the first time, permits the Government to take control over the development of the coal industry, and it makes the Federal Trade Commission an agency to assure continuous publicity of what they are doing.

Senator McKINLEY. Most of the trouble arising in the mining of coal is due to the fact that nobody has control of that industry.

Mr. MARSH. The price which the manufacturers have to pay for coal is one thing that has influenced the prices farmers pay when buying the things which they need.

Incidentally, speaking of this wonderful provision of the American Farm Bureau Federation, they have come out and indorsed the ship subsidy steal, if you please, which is going to stick the farmers for at least $150,000,000 to $200,000,000 a year. I appeared before the committee the other day, and the New York Times, which has a deadly hatred for me and acknowledges it, quotes me this morning editorially as saying it is an ocean-going pork barrel, and it said that I did speak for a class to whom Congress pays a whole lot of attention.

Now, here is a statement which I think Mr. Ford can not realize is in this proposal which he makes, and I therefore hope that it can appear in this record whether the Farm Bureau Federation proposed this proposal to Mr. Ford or whether Mr. Ford proposed it to the American Farm Bureau Federation, and I am going to call your attention to one of the reasons why the previous bill for the Government development of this water power down there—I am speaking of the general project, because I have not studied the differences between Dam 1 and Dam 2 and Dam 2, etc., but one reason that they failed was because they impugned the honesty of those Members of Congress that would not vote for the Government to put a lot of money into a specific plant, for which they got the verbal castigation of their lives. I remember Congressman James Frear, than whom there is no more honest man in America, said that he objected to having his integrity impugned by anybody because he would not vote for a big appropriation.

Here is a fact wh ch I think ought to be called to your attention. This is spoken of as a 100-year lease. It is more than that. I will read section 3 and then turn to section 17. Section 3 of Mr. Ford's proposal reads, and I will read it in part only:

"The company will lease from the United States Dam No. 2, its powerhouse and all of its hydroelectric and operating appurtenances except the locks, together with all lands and buildings owned or to be acquired by the United States connected with or adjacent to either end of the said dam, for a period of one hundred (100) years from the date when structures and equipment of a capacity of one hundred thousand (100,000) horsepower are constructed and installed and ready for service"—

I will stop there and will take up the terms later.

Then, in section 17 of the proposal, it says:

"In order that the said company may be supplied with electric power and the farmers with fertilizers after the termination of the said 100-year leases should

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the United States elect not to operate said plants, but determine to lease or dispose of same, the company shall have the preferred right to negotiate with the United States for such lease or purchase and upon such terms as may then be agreed upon. If said leases are not renewed, or the property covered thereby is not sold to said company, its successors or assigns, any operation or disposal threof shall not deprive the company, its successors or assigns, of the right to be supplied with electric power at reasonable rates and in amount equal to its needs, but in excess of the average amount used by it annually during the previous 10 years."

Now, as I understand it, that is a perpetual feature of the lease. I did not so construe it at first, but I cannot put any other construction on it.

I repeat that if Mr. Ford could be here to attend to this it would be one proposition, but with this great drive being made by financial interests to control all our resources it is different. Mr. Silver read into the record the other day a list of those financial interests. There are four or five pages of them and I can not give you the full list now. There are a number of big banking interests who are trying to get hold of the natural resources, quoted as opposed to this bill. There are two kinds of opposition. If I were a business man wanting to get a natural resource, I would want this principal established absolutely, which is incorporated in Mr. Ford's proposal, or, may I say, in the proposal which I believe the Farm Bureau Federation made to Mr. Ford. I have no legal evidence of that, but I know past records.

Now, as to what is going to happen in the fertilizer line, here is the joker which entitles it——

Senator KENDRICK. Before you leave that, Mr. Marsh——

Mr. MARSH. Yes, sir.

Senator KENDRICK. I want to ask you this question: Are you in favor of a longer period of lease than 50 years?

Mr. MARSH. Absolutely opposed to it. That is the maximum.

The CHAIRMAN. Your contention is that when this lease expires in a 100 years it will still be the right of that company to get the electricity generated by these dams, without limit as to time, equal to the amount of electricity that it had used on an average for 10 years just preceding the expiration.

Mr. MARSH. That is the only interpretation I can put on it, Mr. Chairman, because it says so specifically.

The CHAIRMAN. Of course, if that is a fact, it would probably be impossible for the Government to lease it to anybody else, because they could not get the electricity. Assuming that this company, during the last 10 years of the lease would use all of the electricity they have there, there would not be any to go to anybody else.

Senator HEFLIN. And I believe that Mr. Marsh is the only man who has put that construction on the offer of Mr. Ford.

Mr. MARSH. Well, in answer to that I will say that I do not want to be unfortunate in my construction, but I remember that when we were trying to get the packer-control legislation through about a year ago, we were working on a bill, a real bill, and the American Farm Bureau Federation drafted their bill——

Senator HEFLIN. Senator Kenyon's bill, are you speaking of?

Mr. MARSH. No; it was really the committee bill. Senator Norris worked on it. He was the chairman of the Senate committee, and conducted all of the hearings on it. He did yeoman work on it. The American Farm Bureau Federation put in a bill to control the packers, and one of the provisions was that no packer should be punished when convicted of a violation of any of the provisions of the act until guilty of a second offense.

Now, I was one of the representatives of the farm organizations who indicated that that was hardly a good way to protect the farmers and the consuming public, needless to say. That bill was introduced by Mr. Williams, of Illinois, and I do not blame him. However, I discussed it and I put my own interpretation on that bill. It was killed so dead that it could not be revived whatever effort were made to revive it. It is gone. May I add that it required no particular genius on my part to kill it. Mr. Silver said, "we did not intend to let that stay in"; but during the hearings I brought out that the packers had drafted that bill and they admitted it, although they first denied it, but I proved it on them.

Now, on the question of commercial fertilizer, this proposal says in section 14:

"The company agrees to operate nitrate plant No. 2 at the approximate present annual capacity of its machinery and equipment in the production of nitrogen and other commercial fertilizers (said capacity being equal to approximately 110,000 tons of ammonium nitrate per annum), throughout the lease period,

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except as it may be prevented by strikes, accidents, fires or other causes beyond its control, and further agrees:

"(a) To determine by research whether by means of electric furnace methods and industrial chemistry there may be produced on a commercial scale fertilizer compounds of higher grade and at lower prices than fertilizer-using farmers have in the past been able to obtain, and to determine whether in a broad way the application of electricity and industrial chemistry may accomplish for the agricultural industry of the country what they have economically accomplished for other industries."

This is inserted in typewriting:

"* * * and if so found and determined, to reasonably employ such improved methods."

Now, they do not know, Ford does not know, no one knows, whether they are going to be able to manufacture fertilizer more cheaply, and we know that despite this, the American Farm Bureau Federation has the gall to say they are going to save the farmers $150,000,000 a year on fertilizers. I want to say that that is the most conspicuous illustration of "effrontery" that I ever saw in all my life. Ford does not agree to do it. He does not even say that he is going to earn 8 per cent. [Reading:]

"(b) To maintain nitrate plant No. 2 in its present state of readiness or its equivalent, for immediate operation in the manufacture of materials necessary in time of war for the production of explosives."

I have been getting around to 30 States of the Union once or twice a year, and I am not worried over getting ready for any further war. I will say very frankly that another war would mean the abolition of the institution of private property, which would be a calamity from any viewpoint.

Senator HEFLIN. Don't you think, Mr. Marsh, that if Mr. Ford manufactures fertilizers at Muscle Shoals and charges only 8 per cent profit, that will reduce the price of fertilizers to the farmers?

Mr. MARSH. Well, I think that if Mr. Ford had full control it might, but there is something which was printed in there since the Farmers' National Council indorsed this proposal in principle which I would like to read.

The CHAIRMAN. The Farmers' National Council, Mr. Marsh?

Mr. MARSH. Has indorsed the proposal. This was written in since we indorsed the proposal—the principle, I mean. We did not indorse this whole plan. We thought it was a good thing to utilize this water power down there, but I will say right now that we do not think, knowing what is happening along the line of normalcy, that there was any chance of any Senators making a fight, such as Senator Norris to have the right sort of development of this water power by the Government.

Of course, we would now withdraw our support of Mr. Ford's proposal as it stands, because the council's preliminary plan is just what is planned for in your bill, Senator Norris.

Senator HEFLIN. Do you think there is any chance to pass a bill like Senator Norris has introduced here?

Mr. MARSH. I will say right now that I can tell you better on the morning after election. I think there is going to be an awful good chance, from what I hear all over the country; I think there is going to be an extraordinarily good chance.

Senator HEFLIN. Do you mean after the next election?

Mr. MARSH. The morning after the next election.

Senator HEFLIN. Do you think that they will vote on it before they go out on the 4th of March—most of them?

Mr. MARSH. I do not know. I do not belong to any political party, you see, and I can not tell what will happen; but I will say this: We have to look ahead two or three years. Suppose they do not do this for a year or so. I still maintain that with the present prices farmers are paying for fertilizers, and I am going to show how they are being saved by some honest farmers' organizations down South, if they buy it under present conditions for two years they will have very small cause to complain, compared with what will be the situation if you establish the principle of a 100-year lease, plus this provision in section 17, under which they get power in perpetuity.

I want the farmers to get cheaper fertilizer, and I am going to point out how I think it can be done.

I started to read section 15. Let me continue:

"In order that the farmers may be supplied with fertilizers at fair prices and without excessive profits, the company agrees that the maximum net profit which it shall make in the manufacture and sale of fertilizer products shall

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not exceed 8 per cent of the fair actual annual cost of production thereof. In order that this provision may be carried out the company agrees to the creation of a board of not more than nine voting members, chosen as follows: The three leading representative farm organizations, national in fact, namely, the American Farm Bureau Federation, the National Grange, the Farmers' Educational and Cooperative Union of America, or their successors, shall each designate not more than seven candidates for said board. The President shall nominate for membership on this board not more than seven of these candidates, selected to give representation to each of the above-mentioned organizations, said nominations to be made subject to confirmation by the Senate, and there shall be two voting members of said board selected by the company."

Now, gentlemen, the American Farm Bureau Federation is chock full of bankers and business men and lawyers. I am a member of the grange. Probably 60 per cent of the members of the grange are farmers, or possibly 65 per cent.

The CHAIRMAN. Who are the balance?

Mr. MARSH. Little townspeople. I am not a farmer. I am a farmer's hired man.

Senator KENDRICK. Now, Mr. Marsh, do you think that that statement is correct?

Mr. MARSH. Yes. It is not true out West.

Senator KENDRICK. You must bear in mind that because a man is living in town and is a professional man, that that does not necessarily preclude the possibility of his being a real farmer.

Mr. MARSH. Well, I think you ought to limit the term "farmer," Senator Kendrick, to the man who is absolutely on the farm and doing work on it. I do not think you ought to include, by any means, the man who simply owns the farm and rents it out, because, as I figured out from the census figures and the reports of the Agricultural Department, the tenant farmers last year paid half a billion dollars more ground rent than they ought to. Out in Senator McKinley's own State, in Illinois, certain farmers would not rent their farms for less than $25 an acre a year, as I was told by one of those farmers out there. Now, the men who own those farms are not farmers in that sense. They are not operating the farms. They are landlords.

Senator KENDRICK. If you will pardon me there, Mr. Marsh, I believe——

Mr. MARSH. Certainly.

Senator KENDRICK (continuing). I believe that it is quite possible that you are mixing the two questions. For instance, a man who lives in town and who finds it necessary oftentimes to stay there, does so against his will, or the man, even, who is in public service, may stay there against his will, when his inclination and his wish is to be back on his farm, and he is just as much a farmer as the man who lives right there and does the plowing.

Mr. MARSH. I believe, in fact I know, that the big fight in the farm field in the future is over the land question. Now, I have not been a farmer, although I have worked a great deal of my time in getting through college, in the summer, on the farms out in Iowa, of course, but I am pointing out that in this grange out West the members are pretty straight farmers, but in the East the membership of the grange is quite largely composed of those who are not actively working on the farms. Of course, somebody has to own the farms, that is unquestionably true, and landlords are entitled to a fair rental for them, but the tenant farmers to-day are in the most absolutely unspeakable distress throughout the Nation. They are organizing them mighty fast down in Texas. The farmers and the wage earners are effecting a combination in that State that will turn it upside down in two or three years.

Senator MCKINLEY. I want to interrupt you there just to ask you whether you believe, excepting those persons who are here present, whether there is anyone in public service who is staying here against his will?

Mr. MARSH. I do not know. It is said in Holy Writ, "Whom the Lord loveth He chasteneth"; and I suppose the best way to chasten a man is to keep him here at Washington.

Senator KENDRICK. Well, I have an idea that the Senator had me in mind.

Senator MCKINLEY. No; I excepted those present.

Senator KENDRICK. I know, but I have the impression that many men stay in town who, so far as they are personally inclined, would rather be on the farm. It may be that it pays them better to stay in town and it may be that they are spending the money that they make in town on the farm, but they

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are just as much interested in the work of the farm and enjoy that feature and the attention necessary to give it more than anything they do. I think that is quite possible.

Mr. MARSH. I agree with you, but I have not gotten through with my statement. I did not mean to impugn the honesty of folks who rent out farms. That is perfectly legitimate. It has to be done when folks retire. They may have been bona fide farmers, but I am pointing out a fact which has been clearly established, that in these eastern States, particularly in New York and Massachusetts and the other New England States, about half or more of the members of the grange are young folks in the towns and little townspeople and shopkeepers. That point has been made, and I cite this constituency of the American Farm Bureau Federation to point out the consummate nerve of the Farm Bureau Federation who wrote this thing, excluding an organization which does not admit to membership anybody except the farmer, the National Nonpartisan League.

Now, I think there is a reason for it and I would be very suspicious of the seven men nominated by the American Farm Bureau Federation, which indorsed the Cummmins-Esch law, which smashed agriculture, which fought the Norris farm products export corporation bill; which has stood for every big steal which robbed the farmers, and which opposed nearly every effort that was designed to help the farmers. I want to tell you right now that I would be suspicious of the seven men whom they would nominate.

Now, Mr. Silver said to some Senator, "Let him come and debate this." I spent three days at their convention in Indianapolis in December, 1920, on their invitation to speak and they were afraid to let me on the platform for those three days, although they have $30,000 lawyers, and I can't talk.

Senator HEFLIN. Well, you are a pretty clever talker. Then, they are fooling lots of honest men who have appeared before this committee, if that is true.

Mr. MARSH. You mistake me, Senator. You have been good enough to put me in a class where I do not belong, and I will tell you how to get in it, and that is never to advocate anything that you do not believe in and are not sure it is right, and I guess both of us belong in the same class. I have talked to farmers by the thousands, and they have talked to me, all over this country, and we are suspicious of any organization which, like the American Farm Bureau Federation, has reported in the agricultural conference last January, received from the Chicago Board of Trade—that is, the hundred county farm bureaus, a thousand dollars apiece in cash. That is just four or five lines. May I read that, with your permission, because we would like to see what sort of men are going to be nominated to see that the farmers are protected.

This is the speech of Robert McDougal, of Illinois. They left out of here reference to the fact that he is the president of the Chicago Board of Trade:

"Attitude of the board of trade toward the farm bureau movement—The board of trade looks on the farm bureau movement as the greatest forward step taken by American agriculture in the last 40 years."

Yet you will notice that the farmers have all gone broke since it was organized.

He continues:

"The board of trade helped to start this movement and feels considerable pride in its rapid growth to power. The first farm bureau in the United States, Broome County, N. Y., recently celebrated its tenth birthday, and the speaker of the day pointed out how the financial cooperation of the Chicago Board of Trade with the agricultural and other local interests initiated this movement successfully and put it on its feet. In this way the crop improvement committee of the board of trade was a sort of grandfather to the farm bureau movement. A cash grant of a thousand dollars was made to each of the first 100 farm bureaus formed, beginning with the one in New York State and spreading to Iowa and other Middle Western States. The board of trade took no part in controlling the farm bureau, shaping its policies, or keeping any strings tied to it of any kind. I point with pleasure," asserts this president of the Chicago Board of Trade "to this farm bureau movement, not so much because of our financial investment in it, but because of the vision which was back of our activities."

Now, why stipulate that the American Farm Bureau Federation and the National Grange, both of which have indorsed the Cummins-Esch law, and both of which have opposed the Norris farm products export corporation bureau, which was the only thing which could have saved the farmers last year, should be allowed to nominate the people to decide what is an 8 per cent profit or what is a fair annual cost on fertilizer?

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Senator McKINLEY. Mr. Marsh, may I ask you a question right there?

Mr. MARSH. Certainly.

Senator McKINLEY. Will the farmer or the business man buy fertilizer from Mr. Ford if he can buy it cheaper from somebody else?

Mr. MARSH. No; he probably will not. I doubt whether you could put enough propaganda across to carry that through, and if they do not buy a large supply, I doubt whether there would be a possibility of making 8 per cent, myself.

Senator McKINLEY. I think there is testimony before this committee that if we are going to compete with the Chilean nitrates and other fertilizers you must have power at three-fourths of a mill per horsepower hour, and the testimony of the Army engineers is that the cheapest rate at which power can be made is two and a half mills, or three times that cost per horsepower.

Senator KENDRICK. Does that mean secondary power, Senator?

Senator McKINLEY. I do not know, sir.

The CHAIRMAN. No, that does not mean secondary power. They have not put in any price on that.

Senator HEFLIN. It means primary power?

The CHAIRMAN. Yes.

Senator HEFLIN. You mean that that is the cheapest at which it can be produced now?

Senator McKINLEY. That is, the power.

Senator HEFLIN. Yes. They will probably be able to produce it cheaper than that at some time in the future.

Senator McKINLEY. I was wondering whether he was going to buy the fertilizer after it was made, or whether they would keep on making it and storing it up, if nobody bought it.

Senator HEFLIN. That is a pertinent inquiry, Mr. Chairman. I would like to hear the witness go into that a little.

The CHAIRMAN. That was not a question. The Senator was just wondering who was going to buy this fertilizer.

Mr. MARSH. The American Farm Bureau Federation is losing out in the Northwest; I mean the progressive farmers are getting out of it. They want to make a drive in the Southern States, and all of the farm organizations in existence that are really doing something for the farmers are opposed to them.

R. W. H. Stone is the president of the North Carolina Farmers' Union. They broke loose from the National Farmers' Union because they thought it was too conservative, and affiliated with the Farmers' National Council. The American Farm Bureau Federation is trying to get into that State, and the union is opposing it. In hearings before the House Committee on Banking and Currency a little over a year ago, Mr. Silver said he thought it was a legitimate aspiration for them to speak for all the farmers of America.

Now, to get down to the practical features of it: Mr. Stone is a practical man, and he told me he had saved the farmers of his State three or four million dollars in their fertilizer bill last year by going to a corporation and saying, in effect, "We will buy from just this one corporation, if you will give it to us at a reasonable price." Now, that was a practical proposition, and he did it. He is fighting the American Farm Bureau Federation, and he is doing that because he wants to help the farmers of that State. He is not getting $15,000 a year, like Howard, or $12,000 a year, like Silver, to be flunkies for Wall Street down here. That man is not getting a cent out of that farm organization in North Carolina. They can not afford it. The farmers are broke in that State, like they are all over the Nation.

Senator HEFLIN. Yes.

Mr. MARSH. Now, here is a thing that is inserted in typewriting, and I do not blame the typist for this:

"In order that such fertilizer products may be fairly distributed and economically purchased by farmers, the said board shall determine the equitable territorial distribution of the same, and may in its discretion make reasonable regulation for the sale of all or a portion of such products by the company to farmers, their agencies, or organization."

I do not know what that means. I do not believe Brother Ford read that. This was signed by Henry Ford on the 25th day of March, 1922, and this has been typewritten in that printed matter and has been inserted since the printed statement was prepared.

I might say in passing that I have sent to Mr. Ford the substance of what I have stated to you about the American Farm Bureau Federation and the Na-

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tional Grange, because I make it a point never to say anything behind any man's back that I do not want to say publicly.

Senator HEFLIN. Mr. Marsh, do you object to stating the salary that you are getting?

Mr. MARSH. My total salary—I am managing director of the Farmers' National Council and I am executive secretary of the People's Reconstruction League—is $300 a month. I do not get any salary from the council; I get it from the league, of which the council is a member and to which it contributes. I do not think that situation ought to continue, but, to be perfectly frank, I know the farmers are not in any position to pay big salaries to their representatives to-day. The average money income of the entire farm family for all of its work last year was only about $100, and their taxes averaged $150. I have seen desperate statements, and one man was in to see me the other day from down in Virginia, after that frost, and he said, "There are several of our fellows talking about committing suicide. They are wiped out; their whole crop is gone." Of course, I would not work permanently on the stipend of $300 a month. They will not ask me to, but I mention that as you raised the point, Senator.

Senator HEFLIN. Yes.

Mr. MARSH. It is not germane to the principles of this proposition at all, but I am glad to answer it, because I had raised the other point.

Senator HEFLIN. Yes. You said what Mr. Silver was getting.

Mr. MARSH. But I will say this, that if they would pay $20,000 to a man who would represent them and stand fast, it would be a good investment, but I point to their record.

Furthermore, here is this farm bureau that went into some business—the bureau which wants to nominate seven of the board of directors. They organized the United States Grain Growers (Inc.), and here is their financial report. They spent $589,456. Their president, C. H. Gustafson, wrote me over his signature the other day that they had not sold a bushel of wheat, although they reported that that was spent to enable the farmers to sell their wheat, while the Farmers' Union in Nebraska sells 30,000,000 or 40,000,000 bushels a year. Up in the Northwest a cooperative wheat organization has sold about 20,000,000 or 25,000,000 bushels, and the Equity Cooperative Association has been selling a lot. These people squandered and wasted nearly $600,000 of the farmers' hard-earned money without being a dollar's worth of good to them, and they come here and say, "We want to be directors of the organization to assure you that not over 8 per cent profit is made on the fair actual annual cost." I believe that is ridiculous. They have all of these economic schemes for saving the farmer, but they do not work. They remind me of the fellow out in Missouri who thought he could spit across the Missouri River and he couldn't spit across his own chin. That is true of some of these efforts to make over the whole farm field overnight. It can not be done.

The friendly feeling between Mr. Silver and myself personally was shown after I had exposed the packer control bill, when he said he was not a soapbox orator or an agitator.

Senator HEFLIN. Mr. Marsh, I understand that Mr. Silver testified before the Military Affairs Committee of the House that his salary was only $7,500 a year.

Mr. MARSH. If I am doing him any injustice I will correct it; I will be glad to; it has been reduced very recently, then, if that is true.

Senator HEFLIN. You are trying to be as complimentary to him as you can; you are on friendly terms.

Mr. MARSH. Why, surely—on such friendly terms as those who are striving to serve the interests of the farmers ought to be.

Senator KEYES. Do you know anything about the salaries paid to other Farm Bureau officials in the States, for instance? Do you know what is paid in a State like Illinois; do you happen to know that?

Mr. MARSH. I think it is $8,000 or $10,000.

The CHAIRMAN. Do you know what the head of the Grange in Pennsylvania gets?

Mr. MARSH. John McSparron can not get over $2,000 or $2,500. It is too low a salary for a man of his ability and integrity.

Senator KEYES. I understood you to say that these men get about $8,000.

Mr. MARSH. That is my recollection—eight or ten thousand dollars. I am not objecting to these fair salaries. I am objecting to what the folks do who draw them. It would be better to pension off a lot of these representatives of the farm organizations at $20,000 than to let them draw the salaries which they do draw and pretend to speak for the farmers.

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In passing let me instance this: America has reached the crisis which Europe reached a long time ago. All of our free land is gone. Now, that always makes a change in the economic life and in the industrial and agricultural life of a nation, when its free land is gone, and no superficial action is going to relieve agriculture. You have got to stop speculation in farm land; you have to stop speculation in transportation, which handles the farmers' products; and you must stop speculation in farmers' products and credit, and it is quite a job.

Senator McKINLEY. Mr. Marsh, I noticed the reply you gave to Senator Keyes about the salaries that these State officials are getting.

Mr. MARSH. That is not of importance. I instanced what I thought was the highest. Five or six thousand dollars is common.

Senator McKINLEY. You referred to Illinois. The head of the agricultural department in Illinois, the State department, only gets $5,000 a year. Do I understand you to say that the president of the American Farm Bureau gets $10,000 a year?

Mr. MARSH. Mr. Howard got $15,000. He may have reduced it recently. Mr. Silver got $12,000. He may have reduced it recently. If I have done him an injustice I apologize. I know they were trying to get him to reduce it, and if he has done it that is all right; but I am not raising any objection to farmers' representatives having a fair salary. Some of them are worth as much as Senators and Congressmen.

Senator McKINLEY. But we only get half of that amount.

Mr. MARSH. I know, but you are sure of your job for six years, and these fellows are not going to hang on more than six months longer, some of them. There is quite a difference, and they know it.

Senator McKINLEY. Well, that is true as to some of these Senators.

Mr. MARSH. I looked straight at Mr. McKinley, knowing what year he was elected in.

Now, here is what the Federal Trade Commission said on this fertilizer question, and I want to quote from the report of the Federal Trade Commission on the fertilizer industry to the President of the Senate, or to the Senate itself, in August, 1916. I tried to get their figures right up to date. I understand they are making a further study of this question, but they have not the data available to date. The principles are pretty well put, and I would like to put them forth. I do not mean to be bumptious about it, but I think the Trade Commission could give you in a very short time some information as to where the fertilizer situation could be most directly remedied, that is, through the existing organization of the Government departments, and the price of fertilizer, with the cooperation of the farm organizations, can be reduced.

The CHAIRMAN. Your statement reminds me that the Federal Trade Commission some time ago did make quite an exhaustive investigation of that fertilizer proposition.

Mr. MARSH. In 1916, they told me yesterday, was the last published report that they made. I realize it is just a little bit old, but I want to quote from it.

The CHAIRMAN. I think I introduced a resolution myself, and it was passed by the Senate, authorizing them to continue the investigation and bring it down to date. I do not know in regard to the fertilizer proposition.

Mr. MARSH. I know you did it on the profit of the millers.

The CHAIRMAN. Maybe that was it. I had in mind doing it in regard to the fertilizer; but perhaps I did it on the other, and not on this.

Mr. MARSH. I think it would be a favor to the farmers if you would put such a resolution in now, Senator, because we could get that information up to date, probably, in two or three months, and I think it would be very helpful.

Senator KENDRICK. Mr. Marsh, what is the name of the organization of which Mr. Gustafson is the head?

Mr. MARSH. It is the United States Grain Growers (Inc.). That is the outcome of the investigation made by the committee of 17 which was nominated by Mr. J. R. Howard as president of the American Farm Bureau Federation. There are very admirable members of that committee, and they made a very good report, unquestionably. The principle of commodity marketing is sound, Senator, absolutely sound; but, in our judgment, to scrap the State organizations, which are already doing good work, and to talk about a national organization and getting a million wheat farmers to agree to pool their wheat for five years was not a good thing for the farmers themselves.

Senator Ladd, I understand, who has been very helpful in organizing this United States Grain Growers (Inc.), like all others who have the farmers'

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interests at heart, is very much perturbed over the bad financial showing which I have outlined to you, and I understand that he is having a careful investigation made, because his name was used as having indorsed the whole scheme. But the facts are there, gentlemen. Of course, I am old fashioned. I believe in starting on a small basis and working up.

Senator KENDRICK. It is your idea that the best results would be obtained through local organizations and probably eventually through amalgamation of those organizations?

Mr. MARSH. I think so, undoubtedly, Senator.

Senator KENDRICK. If it proves economical?

Mr. MARSH. If it proves economical; but of this fact I am absolutely confident, and I never reach conclusions by introspection; I have studied this question very carefully, I have talked with farmers and labor leaders and financiers almost all over the Nation, and I can not see any assurance this year of a fair price to the farmers for their products, by and large, except through legislation, such as the bill Senator Norris introduced last June, I think to create the Farm Products Export Corporation, and further action to stabilize the prices of farm products. I do not mean price fixing, necessarily. I believe that has to be done, the fixing of the price of farm products, but the alternative of this: The farmers can not get credit. The operation of the War Finance Corporation, as revived at the behest of Wall Street to defeat Senator Norris's Farm Products Export Corporation bill, has been an absolute failure. The minimum that the present Congress must do, I believe, is to create a Farm Products Export Corporation, similar to the plan devised by Senator Norris Neither he who has pride of authorship, nor those who are indorsing it, are sticklers about the phraseology; but there must be a Government agency which will meet the pooled buying by foreign Governments of farm products, by giving to the farmers here the same sort of credit.

If you gentlemen will read the book "America and the Balance Sheet of Europe," by Bass and Moulton, you will see, as has been developed at Genoa in the last few days, that Europe is in a terrible condition and we are going down with her if we let agriculture go through the same experience that it we went through last year and the year before.

The CHAIRMAN. When you get to a good stopping place there, Mr. Marsh, I want to interrupt you, because I am satisfied that you want to be interrupted.

Mr. MARSH. Yes, sir.

The CHAIRMAN. Earlier in your testimony you referred to a particular clause in the original paragraph 17 of Ford's offer—as the offer is remodeled it is paragraph 18—by which, as you contended, the lease was, in effect, a permanent one. I did not have the Ford offer before me at that time, but I was under the impression, when you testified, that that had been changed, and I sent for it and have just received it. I agree with you that if the language was as it was originally, it would be permanent, but one of the modifications that have been made on the part of Mr. Ford is to eliminate that language. I have it here. The language that has been eliminated is as follows:

"If the said leases are not renewed or the property covered thereby is not sold to said company, its successors or assigns, any operation or disposal thereof shall not deprive the company, its successors or assigns, of the right to be supplied with electric power at reasonable rates and in amount equal to its needs, but not in excess of the average amount used by it annually during the previous 10 years."

That language has been stricken out.

Mr. MARSH. That language has been stricken out?

The CHAIRMAN. Yes.

Mr. MARSH. Well, I was not aware of that. I appreciate your calling my attention to it.

Senator HEFLIN. So it is not subject to the construction you put upon it?

Mr. MARSH. No; not in that respect, if that amendment has been made.

The CHAIRMAN. The copy that you have does not show that change?

Mr. MARSH. No.

The CHAIRMAN. It shows the other changes, but not that one.

Mr. MARSH. I thank you very much for calling my attention to it.

Senator MCKINLEY. That limits it to a hundred years.

The CHAIRMAN. As it reads now, Mr. Marsh, it is like this:

"In order that said company may be supplied with electric power and the farmers with fertilizers after the termination of the said 100-year leases, should the United States elect not to operate said power plants, but determine to lease

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or dispose of same, the company shall have the preferred right to negotiate with the United States for such lease or purchase and upon such terms as may then be prescribed by Congress."

Senator KEYES. Is that the revised proposal up to date?

The CHAIRMAN. Yes.

Senator KEYES. Up to the present time?

The CHAIRMAN. Yes. It still gives them a preferred right, and we have been arguing it all the way through on that theory. It still gives the company the preferred right, but it does not give them the right, in case the United States Government does lease it or sell it, to be supplied with power; but it gives them that preferred right in such a way that Congress may prescribe. That leaves it entirely up to Congress, as I understand the construction now.

Mr. MARSH. That correction emphasizes my query as to whether this proposal was made to Ford by the American Farm Bureau Federation or whether Mr. Ford made this proposal to the American Farm Bureau Federation—a matter which can be set at rest by a few questions.

Now, in this report of the Federal Trade Commission on the fertilizer industry, dated August 19, 1916, the following statement was made. I think they embodied things which we might consider, and I will try to be very brief in presenting it:

"The economic importance of the fertilizer industry, which embraces the production and sale of various fertilizer materials, as well as the manufacture and sale of prepared or mixed fertilizers, is shown by the fact that the value of all commercial fertilizers consumed in 1914 was in excess of $150,000,000."

I understand the amount paid for fertilizers has about doubled. Needless to say we are opposed to a duty upon potash or upon any of the ingredients which enter into the manufacture of fertilizer unless there may be special circumstances which we do not know. You know the question came up during the war. Some concerns had invested a large amount of money and had very large expense and had fixed charges in an endeavor to develop the potash industry. In such a case, instead of having a tariff which would enable all the producers of potash to charge a price which they had to charge because of their war outlay I think it would be better to have Congress pay them something and not to have a general tariff on potash.

Senator HEFLIN. The farmers, as a rule, are against any tariff on fertilizers or fertilizer ingredients?

Mr. MARSH. I don't know of any exception to their opposition to that.

The CHAIRMAN. That applies particularly to potash?

Mr. MARSH. I think it would apply to all of them, Senator.

Senator HEFLIN. If you increase the price to them, they would oppose it, and certainly in the position they are in now there ought not to be any additional burdens put upon them.

The CHAIRMAN. I agree with that, but the point I make is—I may be wrong about it, and I would like to be corrected if I am, and maybe Mr. Marsh knows—what other ingredients used in commercial fertilizer besides potash and nitrates are imported?

Mr. MARSH. I don't know, Senator. I know those are the chief ingredients.

The CHAIRMAN. You don't know whether sulphate is imported or not, do you?

Major BURNS. Ordinarily there is none imported, but it depends upon the market. Last year we exported sulphate and did not import any at all.

The CHAIRMAN. Our import, then, so far as fertilizer is concerned, consists of the importation of nitrate and potash from Germany?

Major BURNS. Germany and France.

The CHAIRMAN. Yes; Germany and France.

Mr. MARSH. This continues:

"The following facts set forth by the report are of special public interest:

"FERTILIZER MATERIALS.

"1. The wholesale prices of nitrogenous and phosphatic fertilizer materials have been governed fundamentally by conditions of supply and demand during the period covered by the investigation, although artificial conditions have at times exerted at least a temporary influence.

"2. The wholesale prices of German potash salts have been arbitrarily controlled by a syndicate of producers of which the Prussian Government is a member, competition in prices having been eliminated since 1910 by an imperial law.

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"3. Farmers' prices of fertilizer materials for cash purchases in carload quantities have compared favorably with wholesale prices, but farmers' credit prices have often been excessively high.

"MIXED FERTILIZERS.

"4. Most of the fertilizers used in this country are purchased in mixed form and not in the form of materials. In the mixed-fertilizer industry there are about 800 concerns operating some 1,200 plants, but the seven largest companies, with their numerous subsidiary and affiliated concerns control more than 58 per cent of the total output. The two largest sell annually over a million tons each, and in the aggregate about 34 per cent of the total output.

"5. The prices paid by farmers for mixed fertilizers have been high in comparison with the cash value of the constituent elements, partly because of credit conditions and the expensive distributing methods of the large fertilizer companies; for these reasons also the profits of the large companies have not been large.

"CREDIT CONDITIONS.

"6. Credit conditions affecting farmers are so burdensome that some action, legislative or otherwise, should be taken to remedy them."

This must sound familiar.

"Any action that would reduce the high interest rates on agricultural credits, particularly on short-time loans, would tend to reduce the farmers' prices both of fertilizer materials and mixed fertilizers.

"SELLING METHODS.

"7. Objectionable selling methods of some of the large mixed fertilizer manufacturers have been the unnecessary multiplication of brands and the operation of controlled companies as independents."

Now, I just outline their conclusions and call your attention, if I may again, to the fact that although there are 800 concerns, seven companies, with their subsidiaries control, roughly, three-fifths, or 58 per cent of the total output. This, of course, was in 1916. You have seven concerns there which really practically have a monopoly; that is, majority control.

Senator HEFLIN. That accounts for the fertilizer trust that we hear so much about?

Mr. MARSH. Yes; and two of them, the two largest, sell annually about 34 per cent of the total output.

These are figures for 1916. There may be some change, but I assume that the same ratio obtains.

The CHAIRMAN. What conclusion did the Federal Trade Commission, on that investigation, reach as to whether there was a wrongful and illegal control of the price of fertilizers?

Mr. MARSH. Senator, it has been years since I have read this, and I have not had time to go through this. I will be glad to summarize it. But may I suggest this, that conditions have changed somewhat, and the Federal Trade Commission must have some expert who could give you a good deal of information, even before they make this further inquiry, and could answer accurately your question.

The CHAIRMAN. I think we ought to send for them, probably.

Mr. MARSH. I don't like to give an opinion. It is only recollection. I simply quote it. I know that they can give it to you.

May I say this? I think that one of the great services which the Federal Trade Commission—which some special interests want to kill—can render in the future, as it has in the past, is in just giving information like this. I don't want a farmer paying $10 a year dues to a farm organization to investigate this fertilizer situation when we have the most efficient investigating agency right here in the Federal Trade Commission, and I know they would be glad to do it and they will give you that information.

Senator HEFLIN. You say that some of these special interests have been trying to kill off the Federal Trade Commission?

Mr. MARSH. Yes, sir. The United States Chamber of Commerce has made up their minds to kill the Federal Trade Commission, but I wrote the President in effect that the party which abolished the Federal Trade Commission would abolish itself, and I think that is perfectly true. It has the entire and unquestioned confidence and respect of an overwhelming majority of the people throughout the United States, of the producers of wealth. I think that no legitimate business man objects to it. They have made their mistakes—the

commission. A lot of these business concerns would be haled into court if it was not for the Federal Trade Commission, whose method, in my judgment, is the much more effective way of handling such a situation. It is a little like this: We have the antitrust laws, and they don't know just where they are, a lot of these business interests and manufacturers. It is expensive litigation to come into court, but to be asked to answer a complaint, and, without counsel, just lay your case before a commission like the Federal Trade Commission and try to get straightened out, it seems to me is a great boon to the honest business man who may have inadvertently made some mistake in his transactions.

Senator HEFLIN. Go your way and sin no more.

Mr. MARSH. Precisely. It is only the companies who want to sin some more that we are after now.

Now, in conclusion, of course I believe we ought to recover about $2,000,000,000 that was stolen from the Government during the war, but I don't believe they would go to jail, the fellows who stole it, and they won't.

The CHAIRMAN. You are very tender-hearted.

Mr. MARSH. Oh, no. I recognize facts. For a year now we have been trying to get the President to make the Attorney General of the United States investigate the several hundred million dollars a year which the railroads have been robbing the people of, and after I asked the President to do that, to tell the Attorney General to investigate them, what did the President—or some one else—do but have the Attorney General investigate me last summer, and I told that Ohio politician who they told me in his State could not be elected dog catcher on a bet, if he would stop wasting the taxpayers' money and investigate the lumber interests, and investigate the meat packers and all these other trusts, he would be entitled to keep on his job, otherwise he was not. But, of course, we know politics is politics, and I don't understand politics at all.

Senator HEFLIN. I recall four lines of poetry that are very appropriate:

> Law imprisons man or woman
> Who steals a goose from off the common;
> But lets the greater culprit loose
> Who steals the common from the goose.

Mr. MARSH. I wonder if that could be inscribed and sent to the Attorney General?

Now, the real issue, gentlemen of the committee, it seems to me, is this: The disposition of the natural resources of the Nation, which are worth literally billions of dollars. The Farmers' National Council is regarded as a radical organization. It is not. Our program is not as radical as that of the farmers' organizations in Canada, which have captured the Government. We believe that anything which in order to be run economically and efficiently must be conducted as a monopoly should be owned and operated by the Government That applies to water power. It applies to the railroads. It applies, at least as to ownerships to the ships. It applies to the coal industry.

Therefore we hope that you will enact legislation to enable the Federal Government to retain the plants which we have constructed down in this Muscle Shoals project, to retain full title absolutely to the water powers of those navigable streams, and to any which may be developed, and that it may be developed as an object lesson of what can be done. I trust that before you get through you can get Sir Adam Beck, who is chairman of the Hydroelectric Power Commission of the Province of Ontario, to appear before you and tell you what they are doing.

The CHAIRMAN. Now, Mr. Marsh, that interests me. Sir Adam Beck is not in this country now, is he?

Mr. MARSH. No, I think not.

The CHAIRMAN. Are you familiar with the report made by an American engineer named Murray, selected by some American corporations, some association, I think, electrical association, or something, anyway some American business men or corporations, to make an examination of the price that the consumer had to pay under Sir Adam Beck's corporation over there in Canada, and what the consumers of America have to pay?

Mr. MARSH. I know of that report, but I am not familiar with it, Senator Norris; but I know that all these big coporations maintain what they call their statistical bureaus, just like the Bureau of Railway Economics, which is maintained by the railroads.

The CHAIRMAN. I have a copy of his report. Mr. Murray reaches the conclusion that this Government-owned system over there in Canada supplies to the consumer electricity at a higher price than the privately owned electric

establishment supplies it to the American people. What do you think about that?

Mr. MARSH. Well, I know that charge is always made, but I happened to be the other day out in your State talking to Mr. R. B. Howell, who is the head of the Omaha, Nebr., electric light plant, and——

The CHAIRMAN (interposing). Water works.

Mr. MARSH. And gas plant. He told me how they put forward the same statement, that the municipality of Omaha was paying more than other localities, and then he told me how they forced the price down all along the line. I think the only answer to that question is to have Sir Adam Beck analyze Mr. Murray's report.

The CHAIRMAN. I have thought ever since I read it two or three weeks ago that I would write to this company over there. I was not satisfied from the slight examination I made of Mr. Murray's report that it was correct at all. It seemed to me all the way through he was making an argument to demonstrate what it looked as though he might have been employed to prove. I don't know.

Senator NORBECK. Mr. Chairman, may I say here that the South Dakota Hydroelectric Commission, of which I was a member for a time, had two of their members in the Province of Ontario for a considerable length of time investigating, and they came back greatly impressed with the work that Sir Adam Beck had done up there. In fact, they were well pleased with it all the way through. There was just one problem that they felt was unsolved, and that was this: Possibly he had undertaken so much and gone so far with it that it was difficult or nearly impossible to find a successor for him when he quit. But that was the only thing. They reported that it was a real success all the way through.

Mr. MARSH. I had a freind who worked for a short time for one of those concerns until she was told how to doctor up her returns to be prejudicial to public ownership, and, like an honest person, she threw up the job.

It is, of course, a question of the greatest importance to the people.

In connection with your bill, Senator Norris, I can not attempt to analyze it, because it is a big question which I do not know about in detail. I do know this, that if we in this country have ability enough to win a war to make the world safe for democracy we must have ability enough to make it a decent place to live in after we have won the war. We have not done it yet. We have got to reduce the cost of living.

Seeing Senator Norbeck reminds me of the fact that South Dakota went over and bought a coal mine in North Dakota, and the State of South Dakota is operating it, as I remember. Am I correct?

Senator NORBECK. Yes.

Mr. MARSH. And they do not call you Socialists out there?

Senator NORBECK. Oh, yes; they call me worse things than that.

Mr. MARSH. You also own a State cement plant, do you not?

Senator NORBECK. I don't know as to that.

If you want my opinion on that subject, I want to say that I believe the Government should do a great many more things than it does, but I believe there are some very sharp limitations beyond which it is not practical for them to go; and I do not think our remedy lies in general Government ownership and management, because I think it would be a farce if carried to an extreme.

Mr. MARSH. May I state, if I am not detaining you too long, the position of the Farmers' National Council is this:

If a thing, in order to be efficiently and economically operated, must be a monopoly, such as the coal industry, or transportation, or the ships, or the water power, as brought out in testimony given by Doctor Van Hise, then the Government should own and probably operate, but certainly own them; but when it comes to private business like farming and manufacturing, with few exceptions, we say hands off by the Government. But the thing that has got to be used by everybody——

The CHAIRMAN. As I understand it, your position can be well stated in a general way by saying where it is necessary or desirable for the purpose of efficiency and economy that there should be a monopoly, you want the Government to either own that monopoly or have very complete control over it.

Mr. MARSH. Absolutely. I think that Dr. Van Hise put it admirably in the brief quotation I gave from his book this morning on the conservation of natural resources. I suppose he would go a little further than he did at that time on operation, but he came ahead quite a little. That was written in 1912.

Senator NORBECK. We have come ahead quite a little since 1912, as public opinion has developed and as the public is prepared to adopt new ideas. When we reach the ideal state we can have socialism. When we can have people who would just as soon work for their neighbors as for themselves, we won't have any more trouble.

Our State has gone further along those lines than any State in the Union, but we have not gone ahead with anything that has fallen down. We have gone ahead with practical business methods. Our State farm loan does business on a much larger scale than the Government itself.

Mr. MARSH. About $40,000,000 you had?

Senator NORBECK. About 40, when the other fellow put in 5 or 6. We have State insurance that saved our people $4,000,000 and carries more than $1,000,000 surplus in the treasury, and we have State coal business that has not done big things, but it has reduced the price $1 a ton, and that makes the people mad. Nevertheless I am convinced that the State can not enter into anything except where you have a material advantage, and I don't believe you can take and run these railroads without greatly increasing the cost of the carrying charge.

I think Senator McKinley visited Panama and knows something about the Government-owned railroad there. The Government owns the railroads in Alaska, and we are appropriating over a million and a half to take care of its expenses. The cost per mile is way out of sight, and the Government has to pay the bill.

The CHAIRMAN. I don't know that we ought to take up our time and fill up the record with the Government-ownership proposition.

Senator NORBECK. I guess you are right.

The CHAIRMAN. But, with reference to that Alaskan situation, in actual experience private parties make failures like that, you know. Anyone is liable to make a failure, whether it be the Government or private individuals.

The operation of the Panama Railway and the ships that have been operated is by a Government corporation, just the same as any other corporation, except that the Government owns all the stock. That is the only difference. That has been conceded, as I understand it, to have been a success from the very beginning.

Senator NORBECK. Just like the Government during the war. They have more men standing around on the pay roll than they have room for.

The CHAIRMAN. But still the operation is a success. We so often forget a lot of those things that can be said truthfully aganist the Government operation of railroads can be said likewise against private operation. The same applies to privately owned operation. But there are some things which can be said against private operation which can not be said against Government operation. For instance, watered stock. That has no place in Government ownership.

But let us go on with the discussion of the bill.

Mr. MARSH. If I may make this statement—because I don't want to be understood as acquiescing in the judgment of Senator Norbeck as to Government and private operation of railroads—I just make the one statement: I stated that, in my opinion, Mr. McAdoo is correct in saying that Government operation per unit was approximately one-third cheaper than private operation. That is my impression. I think Mr. McAdoo proved the case.

Senator NORBECK. I wish you would help us make up the money to pay the losses.

Mr. MARSH. The fellows who were running the railroads had made up their minds, Senator Norbeck, that they were going to kill any possibility of Government ownership by sabotaging Government operation. I have learned myself from employees of the railroads how they were instructed by the men higher up to waste things and to ruin the service.

Senator MCKINLEY. Is this all going into the record? It has no relation to Muscle Shoals.

The CHAIRMAN. It is not, I guess, at all pertinent to what we are considering here and we might just let the Government-ownership testimony be all stricken out.

Senator HEFLIN. We have let a whole lot go in and we might as well let that stay in that has already gone in.

The CHAIRMAN. I have no objection to it.

Mr. MARSH. I would make one suggestion in the way of detail and that is whether, in developing this Government water-power plant to generate electricity and possibly to manufacture fertilizers it would be wise to adopt the policy, which, evidently, Canada has adopted, Mr. Chairman, and instead of providing for a board of directors of three, have one executive, like Sir Adam

Beck, up in Canada, who has had charge of the Ontario Hydroelectric Power Commission, and then to have your board of directors to supervise, but just to have one executive who will be responsible for the entire management. That does not affect any of the provisions of the bill except that.

Senator NORBECK. Then contract with the Lord to have him furnish some more Sir Adam Becks. Then we will be all right.

The CHAIRMAN. If they will let me pick them I can get a Sir Adam Beck and get one every day in the week.

Mr. MARSH. I think probably the way the Lord will answer that prayer will be to have us experiment a little, because you can not develop those men overnight. But, as Senator Norris has said, there are such men, who are to-day serving big corporations, who would love to serve the public in that way. I think that is what you had in mind—they would much rather serve the public than serve a corporation. I hope that this matter will be pressed immediately. The question is raised whether you could get public sentiment behind it. I don't know. Certainly you should. When I get out and talk the newspapers give me a lot of publicity, and I am going to be in about 17 or 18 States in a couple of weeks—as I am leaving for the coast. I hope that the proposition will be pressed. There are some changes, doubtless, that you will want to make in the phraseology of this bill but the fundamental principles are absolutely right.

The Government has invested a large sum of money. Whether it was wasted or not is not germane here at this time, because it was done under the stress of war. It should retain the plant which it has constructed. I understand they are deteriorating very rapidly, and naturally so. Four years or so have elapsed since the armistice. I think you will get very wide support for this bill, Mr. Chairman. I am sure that the American Farm Bureau Federation should be more than delighted to revert to their original position on the matter and show that they were in earnest when they indorsed it before, and I know you will have the backing of most of the large farm organizations. I call your attention to the fact that the American Federation of Labor has come out last year much more strongly than ever before in favor of the Government retaining these natural resources and developing them for the benefit of the entire public, and not for any stockholders.

If I can help you any in getting this through, I am going to mention it in my talks this summer and hope we can get it by, because it is a practical proposition: but rather than let the farmers get their fertilizers for $10,000,000 to $25,000,000 a year cheaper, if you please, and pay $100,000,000 a year extra to monopolizers of natural resources, I would withdraw that offer of Mr. Ford's; I would not accept the offer of Mr. Ford, but go ahead with this Government-operation plan, and then you might possibly get Mr. Ford to run that thing. That is my suggestion.

Senator HEFLIN. If Mr. Ford should take this Muscle Shoals project for a shorter period of time, would you favor letting him have it?

Mr. MARSH. I will put it this way: I would consider very carefully Mr. Ford as the executive to administer that for the Government.

Senator KENDRICK. Would not you be perfectly agreeable to a plan under which the Government retains every right to the property, but leases it to Mr. Ford for a reasonable number of years—say 50 years—and that Mr. Ford in his agreement with the Government meets their requirements in a businesslike way, so that there would never be at any time an entire divorce on the part of the Government from control of the natural resource there?

Mr. MARSH. No, Senator Kendrick; for this reason: The issue is much more important than Ford. The issue is whether our natural resources are to be devoted to the American people.

Senator KENDRICK. I understand. Let me interrupt you there. My idea is that we are supposed in the handling of these Government resources, first, to not alienate the title. That is the first thing, and I think the most important. The next thing is to handle it in a businesslike way. Now, if we can do it through this method, that would be the way we would do it if we owned it privately and we were interested in getting the best results from it. It seems to me it might as well go to Mr. Ford as to any other individual, provided it can be done in a sensible and satisfactory way.

Senator MCKINLEY. In other words, Senator Kendrick, you mean rather under the control of the Federal Power Commission?

Senator KENDRICK. Yes; something on that order. The two points, Senator McKinley, are that under no circumstances would I want to alienate this title, even to give him a lease for a hundred years.

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Senator McKINLEY. But the Federal Power Commission would retain control?

Senator KENDRICK. Your children and my children might want to and might find it necessary to act in an entirely different way in 50 years from the day this lease is made, and they ought to have the right to do so, if they wanted to change it.

Mr. MARSH. Senator McKinley, answering your question, in Mr. Ford's offer first he is going in to develop this to get power to manufacture automobiles or other things and to make all the money on them. He proposes to get this natural resource at very low terms, and he is going to make money out of it, and I don't believe that any individual, however good, is entitled to make money out of a natural resource. Therefore, if we accept this offer of Mr. Ford's, you give acceptance to the principle, which you will have hard work in denying to others who come later.

Senator KENDRICK. Mr. Marsh, I take it from your statement—as the chairman has pointed out, I do not know that it is at all pertinent, but we are discussing the best method to handle this proposition, and now following up the reason that you have advanced, the Government must necessarily, if it is unwilling for any corporation to make money out of this power, handle it all itself, control the whole situation and control the industry. After all it becomes an industrial proposition, to see that the power is properly used under the supervision of the Government to prevent unfair dealing and unfair control in the way of monopoly, under the supervision of the Government. It seems to me that our system of government has developed the fact that it is more economical to do it through individual and corporate efforts rather than through the Government.

Mr. MARSH. Well, I can only give you the opinion of our people, and I read first the actual position taken by the Farmers' National Council on the question of natural resources. We believe that the Government should develop this water power. We do not believe that it should give a lease for over 25 years. That would be the last alternative. We believe it should control this water power, should sell the product practically at cost, plus, of course, an allowance for depreciation and amortization and eveything of that sort, and all fixed charges; but we do not believe that Henry Ford should be permitted, or anybody else, to get this water power and to use it to reduce the cost of manufacturing automobiles or anything else, and then retain to himself the advantages of the reduced cost, which he would do, and which he would be entitled to do; but that motive power should be made available to anyone on equal terms, by which I do not mean a man who would use 10 kilowatts would pay the same as the man who used 100,000, but for equal service equal payments should be made, and I repeat, when the question of monopolies is involved, we have reached the parting of the way in our Nation, and we might as well confess it. I have in my pocket a list of some of the American multimillionaires.

The Rockefeller family is worth from three billions to five billions; the Pratt family from three hundred million to four hundred million; Harkness four hundred million, and there is this long list. How did they get it? By control of natural resources, including transportation and pipe line as in the case of the Standard Oil. We have got to stop that. More than that, we have got to take back by taxation, through an inheritance tax, from fifty to seventy per cent of these fortunes. Why should we continue a system which has built up these dangerously large fortunes? I would just as soon trust Ford with a big fortune as anybody else, but the point is it is not a sound proposition. We want to reduce the price of things, and we have got to reduce the cost of producing those things, and the motive power is a big factor. This does not apply alone to this one State of Alabama or this one project; it applies throughout the Nation, where they are trying to grab everything.

When I was out in California last fall I saw Mr. William Kent, who told me he was going into a big fight for the State to expend $500,000,000 in developing water in that State and Rudolph Spreckles and the labor organizations and progressive farm organizations are in for that fight. I think it would be a blow to every such undertaking, and this is only one of several, if we should alienate or turn over to private individuals this proposition down at Muscle Shoals, but I can say that, because everyone knows when we say that, that it is not a question of Mr. Ford as an individual. It is not a personal matter. It is solely a principle, because you would trust him and I would trust him with anything, personally.

Senator KENDRICK. I understand that while it is not personal so far as Ford is concerned—and it is not so with any of the members of the committee—but

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following out your argument, it seems to me you would involve the Government in every kind of manufacturing enterprise in order to handle that power.

Mr. MARSH. No, Senator. I did not make that clear. I draw the line distinctly and very clearly. There is the waterpower given by God. To make it valuable there has to be some investment in plant. That investment should be made by the Government; that is, collectively for the people. The product should be sold; that is, the power should be sold at equal rates to all and on equal terms to all. There the Government responsibility ends, as far as this corporation is concerned, the Government's responsibility ends, but, as I said earlier, suppose we develop the power and we sell electric power for commercial purposes to a boot manufacturer. This commission which develops Muscle Shoals probably ought not to have anything to do with the price of shoes, but some other commission. That would be too big a propositin for one. But the Government has got to say, "Now, this water must be used to reduce the cost of living, which would mean the Government retaining it and not Ford or anybody else making a profit on the development of this water-power proposition."

Senator KENDRICK. I think I get your idea clearly now. Your idea is for the Government to complete the dam and for the Government itself to sell the power to anyone who wants it, but not all to any one person.

Mr. MARSH. No; that as far as possible it should be distributed so as to encourage small concerns, manufacturing and others, and not to give a special advantage to any big concern.

Senator KENDRICK. Then is it your idea that the Government's responsibility, so far as the price fixing of the products manufactured is concerned, ends with the sale of the power? That is your idea, is it?

Mr. MARSH. As far as this branch of the Government responsibility is concerned, it ends there, yes; but then if we give the Federal Trade Commission power to require business concerns in the United States to take out an elective license, to which I referred, which is provided in the Steele bill now pending in the House; but that is another proposal. We are sticking now to this question, How shall the motive power developed by the Nation's water power be used to the advantage of the public? Certainly one way is by making an experiment down here at Muscle Shoals, keeping the cost down all we can. You ought not to charge to the cost of production any of the cost that was due to unusual war conditions.

Senator KENDRICK. Just right there, I want to ask you one question: Would you be agreeable for the Government to operate this, to own and operate it—that is, the power plant—and to conduct the fertilizer plant under the supervision of this commission provided and to sell the balance of the power to the highest bidder?

Mr. MARSH. I think the principle of that would be the right thing.

Senator MCKINLEY. In a few words, you urge Senator Norris's plan?

Mr. MARSH. Yes sir, just as I did before.

Senator HEFLIN. You are opposing Ford's offer now?

Mr. MARSH. I am opposing Ford's offer, but I will tell you I am not opposing it just for political purposes, but I believe it is a case where the Government should go right into the proposition and run it, and I doubt if Henry Ford, a man of 60, could give the attention he has got to give to his own automobile business and this proposition. I don't think of a better way for Henry Ford to round out his career of beautiful service than to go and make a success of a proposition like this for the Government.

Senator HEFLIN. He says he will make a success of it and he will sell fertilizer to the farmers at half the cost they pay now.

Mr. MARSH. No, Senator; I don't think he says that. That statement is made by the Farm Bureau Federation, who have got to throw out a bluff to keep any of its members.

Senator HEFLIN. He has not stated it here himself, but his friends, who know him well, and who have talked to him, tell me that he will make fertilizer and sell it for half what they are paying to-day. Would not that be a great blessing to the farmers of the country?

Mr. MARSH. It would be a great blessing to the farmers of the country. Let me get this correctly. It would be a great blessing to the farmers of the country to get their fertilized at half price, but even getting fertilizer at half price would be a penalty too much for the farmers to pay if as the price therefor you are going to permit a continuance of the present system of private exploitation of natural resources.

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The CHAIRMAN. Don't take that too seriously, Mr. Marsh, because Senator Heflin's question is founded on two or three things. He says his friends told him that some friend had told him that Ford had told that fellow that he could make fertilizer at half cost. Now, if that is true that is a good thing.

Senator HEFLIN. Now, Mr. Mayo, the representative of Mr. Ford, said that here.

The CHAIRMAN. There is some doubt about it being true, and some doubt even about Ford ever having said that.

Senator HEFLIN. That is what Mr. Mayo said, that he could make it at half the price. All of his friends outside who have talked to me about it tell me that he will do that, and also he says he will use 500,000 horsepower and get it out of that river.

Mr. MARSH. What is he going to pay for it?

Senator HEFLIN. Pay something that is reasonable. But here is the situation we are up against it, Mr. Marsh, using this project down there to accomplish something, or letting it lie there and never be developed. Now, it has been lying idle ever since the Government quit work on it, and not until Mr. Ford made his offer to take it up and carry it on and complete it and use it did anybody else come in and offer to do anything with it at all. Now, then, don't you believe that the fertilizer trust and other powerful concerns are doing their best to defeat Ford in the offer that he makes?

Mr. MARSH. It may be they are, and that is not involved in the question at all. They would be just as bitterly opposed and they were just as bitterly opposed to the Government doing anything.

Senator HEFLIN. Certainly. Now, won't they oppose Senator Norris's bill just like they have opposed Ford's offer?

Mr. MARSH. Unquestionably they will.

Senator HEFLIN. Is it not their purpose to defeat any step on the part of the Government or private enterprise to complete that dam?

The CHAIRMAN. Will you just permit me to suggest I wish you would make the same kind of argument for my bill, as we call it, as you do for Ford. You say we can not get this so-called Norris bill because these special interests will fight it, and then you say we have got to have the Ford offer because the special interests are fighting it.

Senator HEFLIN. Well——

The CHAIRMAN. If they can defeat my bill then they can defeat Ford's.

Senator HEFLIN. I am hoping the House will pass the Ford bill or offer, which I understand they will, and if the House goes on record for it, then that is the best thing in sight for the Senate to do, to accept the Ford offer, because then we will get something out of Muscle Shoals; but if we pass something else and the House has gone on record for another proposition, then there you are deadlocked.

The CHAIRMAN. You are for the Ford offer because the special interests are against it, and you are against my bill because the special interests are against it.

Senator HEFLIN. Oh, no.

The CHAIRMAN. The special interests objection works one way with you on one thing and another way on another thing.

Senator HEFLIN. I am for the Ford offer because I believe it is the most feasible thing. I believe we can come nearer getting it than we can anything else.

The CHAIRMAN. It is because they don't oppose it quite so hard, then, as they do mine.

Mr. MARSH. Senator Heflin, you have asked several questions and I want to answer them very specifically.

In the first place I regard the men in charge of the American Farm Bureau Federation and the National Grange as absolutely dishonest and betraying the farmers of America. If this be criminal libel I ought to be in jail, for I have said this in about 18 States, and proved it.

I am, therefore, absolutely opposed to permitting men nominated by these organizations which have indorsed, one or both of them, most of the big steals such as the Cummins-Esch law, which has crushed agriculture, and which have opposed all practical methods such as the Norris Farm Products Export Corporation bill, to help farmers from having any control over such a plant.

Senator, are the Democrats willing to permit a Republican administration to establish the principle of Government ownership and development of the water power of the Nation or are the Democrats using Mr. Henry Ford in this matter for political purposes as a possible presidential candidate in 1924? In other

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words, will the Democrats—recognizing, as I do, that the Republican administration in full control is responsible and ought not to play at politics—establish the principle of the 100-year lease, or back up the plan to have the natural resource of the country developed for the people's benefit?

Senator HEFLIN. Those are questions that are rambling through your mind?

Mr. MARSH. They are rather rampant over the country. Of course, the Republicans have got to take all the responsibility for what happens under this administration, but at the same time here is a vital issue on which the Democrats are going to have a vote, and I want to make this clear, not in connection with the council, but I am also a member of this Conference for Aggressive Political Action. We are going to back Republicans and Democrats. We do not know the name "Republican" or "Democrat" for the United States Senate, for Congress, or for President, or anything else. But here is a great issue. Are we going to embark upon a policy of alienating control of our natural resources for a period of a century?

Senator HEFLIN. Well, now, I have never even heard Mr. Ford discussed amongst Democrats as a possible candidate for the Presidency. That is news to me, that you suggest here that we are trying to use Mr. Ford as a candidate. The Democrats that I know anything about and who favor the development of Muscle Shoals are doing it purely because they think it ought to be developed. It is a great power site, and it is obstructing navigation as the dam now stands, and there is power going to waste there, thousands and thousands of horsepower. The farmers of the country, whom you claim to represent in part, are absolutely at the mercy of the Fertilizer Trust. They have no way whatever to control the price they will pay for the fertilizer that they have to buy. We are trying to relieve those people from the clutches of the Fertilizer Trust; trying to lift some of the burdens off of their backs.

Mr. Mayo, who represents Mr. Ford, testified here that Mr. Ford thought he could, or intended to manufacture fertilizers and sell them to the farmer at half the price he is paying to-day. Now, then, you are willing to put your opposition against Mr. Ford, although the House may accept his offer, and it looks like the most promising proposition in sight—you are willing to put your opposition against his offer and support something else that is contrary to the position the House takes, and throw the two bills in conflict and further postpone and delay development of Muscle Shoals.

Mr. MARSH. You put it in that way. What I would do is this. I would never sacrifice dollars to be able to invite pennies. I am old-fashioned, I admit. I am never fooled by any gold brick. I know what the basis of the great fortunes of America is—control of our natural resources.

I will make this statement: If the Senate and Congress of the United States wants, it has the power, and it can reduce the price of fertilizer to the farmers 15 per cent to 25 per cent in a very short time, with the cooperation of honest leaders of farm organizations, like R. W. H. Stone, president of the North Carolina Farmers' Union. If these fertilizer men are profiteering—and some of them are—the Attorney General is not doing his duty if he does not stop it.

Second, it is pretty clear that nothing definite will be done with reference to cheaper fertilizers for the farmers under the Ford proposal for anywhere from 1 or 2 or 10 years, whereas before this Congress adjourns you can make the Attorney General prosecute this present fertilizer combination or trust, as they are called, and reduce the prices down to a fair figure. Now, that should be done immediately. But as to establishing the principle of letting a good man do a bad thing for a hundred years, our crowd won't stand for it.

Senator HEFLIN. You would rather let the dam stand as it is and the whole project lie idle for 100 years than to permit anybody to use them for 100 years and do good with them?

Mr. MARSH. It won't stand idle for 100 years. You are stating a hypothetical proposition now absolutely.

It won't do it. The American people are waking up. In 10 years there is going to be a different Congress here, and they are going to put some of these things across.

Senator HEFLIN. Yes.

Mr. MARSH. Yes; and I doubt if there will be any material delay if you do not pass this Ford plan at this time.

The CHAIRMAN. We will adjourn until 10.30 to-morrow morning.

(Whereupon at 12.45 o'clock p. m. the hearing was adjourned to 10.30 o'clock a. m., Friday, May 12, 1922.)

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MUSCLE SHOALS

HEARINGS

BEFORE THE

COMMITTEE ON AGRICULTURE AND FORESTRY UNITED STATES SENATE

SIXTY-SEVENTH CONGRESS

SECOND SESSION

ON

S. 3420

TO PROVIDE FOR THE MANUFACTURE OF EXPLOSIVES FOR THE USE OF THE ARMY AND NAVY, TO PROVIDE FOR THE MANUFACTURE OF FERTILIZER FOR AGRICULTURAL PURPOSES, TO INCORPORATE THE FEDERAL CHEMICAL CORPORATION, AND FOR OTHER PURPOSES; AND

ON

THE HENRY FORD MUSCLE SHOALS OFFER; OFFER MADE BY THE ALABAMA POWER CO., PROPOSING TO COMPLETE WILSON DAM; OFFER OF FREDERICK E. ENGSTRUM FOR MUSCLE SHOALS, AND OFFER OF CHARLES L. PARSONS FOR PROPERTIES AT MUSCLE SHOALS, ALA.

PART 4

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MUSCLE SHOALS.

FRIDAY, MAY 12, 1922.

UNITED STATES SENATE,
COMMITTEE ON AGRICULTURE AND FORESTRY,
Washington, D. C.

The committee met, pursuant to adjournment, at 10.30 o'clock a. m. in the hearing room of the Committee on Commerce, Capitol Building, Senator George W. Norris presiding.

Present: Senators Norris (chairman), Ladd, Norbeck, McKinley, Harrison, and Heflin.

The CHAIRMAN. Gentlemen, the committee will come to order and we will proceed with Mr. Swann.

STATEMENT OF MR. THEODORE SWANN, PRESIDENT OF THE FEDERAL PHOSPHORUS CO., ANNISTON, ALA.

The CHAIRMAN. Mr. Swann, will you please give your name, age, occupation, etc., to the reporter?

Mr. SWANN. Theodore Swann, president of the Federal Phosphorus Co., Birmingham, Ala., manufacturer; 35 years of age.

The CHAIRMAN. You are the youngest expert the committee has had before it, Mr. Swann, and you ought to be the most modern.

Mr. SWANN. I have been in business 31 years.

The CHAIRMAN. Ever since you were 5 years old?

Mr. SWANN. Ever since I was 4 years old; yes.

The CHAIRMAN. You know what we are considering, Mr. Swann, and I would like to have you go on and, in your own way, give us all the information you can.

Mr. SWANN. The present method of manufacturing fertilizer, as is true of many other things, will have to be revised from time to time in order to reduce the cost. You have been considering at Muscle Shoals the question of ammonia, one of the three elements that goes into the manufacture of fertilizer.

We have developed at Anniston, Ala., after more than three years experiments, the commercial production of phosphoric acid in the electric furnace. Phosphoric acid made cheap by this process can be used to fix ammonia. Briefly described, the average mixed fertilizer contains approximately 3 per cent of ammonia, 9 per cent of phosphoric acid, and 3 per cent of potash, making a total of 15 per cent of plant food thatis in a ton of mixed fertilizer.

The CHAIRMAN. Is that what you call the 3-9-3 fertilizers?

Mr. SWANN. That is the 3-9-3. Down South we call it 9-3-3.

Of course there are many other mixtures for different crops in various sections of the country, but perhaps this mixture is the average used. There is a considerable quantity of nitrate of soda used directly, and some 16 per cent acid phosphate used in direct application to the soil. There are many other combinations, but I am speaking of the average in order to give you a more intelligent idea of how we propose to reduce costs not in theory, but in practice.

Of the three elements, ammonia represents, by weight, 20 per cent of the total.

First, let us consider the production of ammonia at Muscle Shoals by any of the synthetic processes. To the cost of ammonia there will be added the cost of sulphuric acid to produce sulphate of ammonia.

This extra cost we are trying to avoid, by fixing the ammonia gas with phosphoric acid and saving the cost of sulphuric acid. This is also true of ammonia from by-product coke ovens and gas works, that have a capacity estimated at 550,000 tons of sulphate of ammonia per year.

To produce a ton of sulphate of ammonia containing 25 per cent ammonia the by-product coke oven manufacturer must buy a ton of sulphuric acid as a wrapper to

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wrap up the ammonia gas from the by-product coke oven. Let us assume that the average price, and of course that is subject to variation, of sulphate of ammonia is $50 a ton and the average cost of the sulphuric acid delivered to the by-product coke oven plant is $15 a ton. Then the by-product coke oven manufacturer only gets $35 for the ammonia content of a ton, of sulphate of ammonia, and he must always have extensive storage facilities to store sulphuric acid and to handle it; saturators where the ammonia gas bubbles through a bath of sulphuric acid, a centrifugal for spinning and drying it, and so forth, and if he could sell all his ammonia liquid at $35 he would have more net profit than if he sold it as sulphate of ammonia at $50 per ton.

Let us see what happens? He buys a ton of inert material—too much of which sours the soil; he gets 25 per cent plant food from a ton of material. Out of 2,000 pounds he gets only 500 pounds of plant food. The other 1,500 pounds do no good, but costs something to sack and handle, and load on the railroad car and for freight on 75 per cent of inert material.

Senator McKINLEY. Why do they do that?

Mr. SWANN. Because up to the present time this has been the only commercial way of fixing the gas into a salt so that it can be used.

Now, we come to the process that we have developed on a commercial scale at Anniston, Ala.

The present method of making acid phosphate, the phosphoric acid content of fertilizer, is to grind phosphate rock, which contains an average of approximately 32 per cent phosphoric acid, and treat it with sulphuric acid, making an available salt by a process called acidulation, and obtain an average of 16 per cent phosphoric acid, commonly called acid phosphate or superphosphate. Then by the time it is mixed it contains about 8 or 9 per cent, or, say, an average of 9 per cent, so that, roughly speaking, the finished material contains about one-fourth of the plant food value that was in the original raw material. I do not believe you can show another great industry that dilutes its material and ships out in the finished form only one-fourth the amount of product contained in the raw material.

We charge into the electric furnace phosphate rock, using the Tennessee brown or blue lump, or Florida pebble. We charge silica rock or sand as there is an excess of lime present, and you gentlemen who are acquainted with the blast furnaces know they use limestone in fluxing out the excess silica present, whereas we have an excess of lime present and use silica rock to flux the lime.

The CHAIRMAN. You just reversed the operation?

Mr. SWANN. We just reversed the operation; yes. We also use a little coke braize—not as a source of heat, but as a reducing agent. We charge some cast-iron borings, to improve the operating condition of the furnace and produce ferrophosphorus, an alloy used in the manufacture of certain kinds of steel.

The heat of the electric furnace evolves the phosphorus present in the phosphate rock and is drawn off in the form of elemental phosphorus. In the inclosed furnace air is admitted, and when the phosphorus comes in contact with the air it burns to phosphoric pentoxide, a dense, heavy, white fume or gas. This is carried in gas mains through a cooling system and by condensation and electric precipitation is collected as a liquid, containing approximately 65 per cent phosphoric acid.

Now, let us see what we have done. The other process, using old methods—and I use the term "old method" advisedly because it is slowly but surely being superseded—dilutes it one-half, by the first conversion, from 32 to 16. By our process we raise it from 32 to 65, which not only reverses but doubles the "old method" on concentration. Our object is to get plant food delivered to the farmer in the most concentrated form, in order to save freight bags and all incidental expenses of handling it, so as to reduce the cost.

What is going to be done with this liquid phosphoric acid? The farmer won't use it in liquid form. I think later for some crops he will dilute with water and apply by spraying. But for the moment let us pass that as a dream that may come true. Here is liquid phosphoric acid, 65 per cent [indicating sample].

The CHAIRMAN. But let us pause right there. There is not any question but what if the farmer should use it, it would be a great economy, even though that economy were only in the handling and the freight alone.

Mr. SWANN. Absolutely no question about it; and I think I can satisfy this committee by explaining just the plain common sense back of it without any theory. Would you rather pay the freight on 1 ton than on 5 tons?

The CHAIRMAN. That is the point.

Mr. SWANN. That is all there is to this story; nothing else.

We take this liquid phosphoric acid and we can do three things with it that will have a tendency to cheapen the cost of fertilizer. We can grind phosphate rock just as the ordinary manufacturer does; and use liquid phosphoric acid to acidulate or

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treat ground phosphate rock and make triple superphosphate containing 48 per cent phosphoric acid, or three times the strength of the ordinary acid phosphate.

Roughly speaking, of this product about two-thirds comes from the liquid and one-third from the rock, the last third being obtained very cheaply, as concentrated phosphoric acid can be used to treat ground phosphate rock and make available the phosphoric acid content in the same manner as sulphuric acid, thus using a liquid plant food instead of an inert material.

Taking up the question of ammonia gas, produced by the by-product coke oven process, the cyanamid process, the Haber process, the Casale process, or any of the processes, and you fix ammonia gas with phosphoric acid, a plant food, and use a liquid plant food to wrap up a gaseous plant food and produce a salt, ammonium phosphate, in varying proportions up to 13 per cent ammonia and 62 per cent phosphoric acid. You put into a ton of material by this process 75 per cent of plant food, containing two of the three elements of fertilizer, how are you going to get the third, potash? There are several ways to obtain potash. We were fortunate enough to build a great big plant during the war for the production of ferromanganese. This plant was finished and produced ferromanganese during the war to an extent which was quite a substantial percentage of the total of the United States. When the war demand ceased the English came into strong competition with domestic producers of ferromanganese and we found it unprofitable to continue operation and therefore had to turn our plant to something else. I started to experiment on everything that had ever been made in an electric furnace. We had a map made showing the location of the raw material, the principal points of manufacture and of consumption; you could look at this map and say, "No, we don't want to make that in Alabama. We tried to find something which could be produced on a competitive basis at our plant, and finally determined upon something that had to do with phosphate rock, because the United States is supposed to contain something over 60 per cent of the world's supply of phosphate rock, and we are substantially midway between Florida and Tennessee, which contain great phosphate deposits of the United States not taking into consideration the western deposits, because they are too far away.

We obtained from our neighboring State, Georgia, potash-bearing shale, where there is a great tonnage. There is also close to Muscle Shoals potash-bearing shale that contains an average of about 8 per cent potash, and instead of charging silica rock into the furnace to flux out the excess lime, we charged in enough potash-bearing shale so that the silica contained in the shale would flux the excess lime, and contrary to many of the experts who, at that time, said we could not do it, we collected a potassium phosphate, which is a combination of phosphoric acid and potash.

Here [indicating sample] is a product that we collected on September 12, 1919. You see it is still in solution. It contains 7.94 per cent potash and 66.7 per cent phosphoric acid.

We also charged shale into the furnace by itself, volatilized the potash and collected it by electrical precipitation, and obtained as high as 40 per cent potash. This is a powder [indicating sample]. Strange as it may seem, the liquid and the powder came from the same process in the same way, and when they are combined form a liquid potassium phosphate.

I am not prepared to say to this committee that it is the cheapest method at the moment of obtaining potash. I think that with the low rates of exchange potash can be bought from Germany or France cheaper than it can be made by this process, under present conditions. But you have always this to fall back on. They can not charge you over a certain price for potash, because if they do you can make it yourself in the most concentrated form.

The CHAIRMAN. How does the price compare with present market prices?

Mr. SWANN. Senator, we made potash when everything was high, and potash was selling for $4 to $5 a unit. We have not made any recently, because we have been producing the food grade phosphoric acid in order to make this development pay its own way. I will not go into detail with regard to the method that we have used in this development or how much money we have spent. We expended many hundreds of thousands of dollars in experimental work; in fact, several times our total capitalization on this development up to date.

We have not made any potash from shale due to the present price of power, nor do we expect to or intend to, except to show and prove that it can be done. Later on we are going to get some cheaper power. I will say this, that, in my opinion, with some of the cheap secondary power which is available for short periods of the year, you can afford to make potash—or, I will put it in another way. You can not afford not to utilize the power that otherwise might be lost.

I am, essentially, a power man, that being my early training. I was sales manger for the Alabama Power Co. shortly after they started, and prior to that with a company

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in West Virginia, where in the same capacity, I sold the output of their plant before it was finished. Therefore my early training was in connection with the selling and utilization of power. It was only natural when entering business for myself, that I should take up electric furnace operation as I had spent 10 years in what was in effect the study of the relation of power to the product.

Furthermore, in the South we have seasonal stream flow. By that I mean a great deal more power is available for seven, eight, nine, or ten months out of the year than for the total year. I wanted to find some industry where the investment cost was so low, where the cost of equipment was low, and where the cost of labor was small, but where you could afford to use power for seven, eight, or nine months out of the year and make money on your investment. That is what I have been searching for during the past five years. It is a well-known fact that there are many power sites in the South that could be developed. There is always a certain amount of secondary power which you can not afford to make primary notwithstanding the fact that storage reservoirs will be built, which will also serve to relieve the flood conditions. This matter is before Congress and in due time will receive consideration. But you can not make all of the power primary; as it would not be profitable to store all of the water and distribute it evenly over the entire year. The fertilizer industry is a seasonal business, so it seems rather natural to develop the use of seasonal power for a seasonal business.

My whole thought has been to work my theory out, but I have had to make the operation pay. I will admit that it did not pay for a while, and in the first stages we spent all the money we had—not only that, but the money of a lot of other people; however, it is paying now, and we are making money.

I stated that we had a total of eight furnaces and that we were running one. Some one asked me when we were going to put on the second furnace, and I said when we made enough money out of the first one to put on the second one, to provide working capital. This we did.

When I was before the House Committee on Military Affairs we were operating one furnace, and we made enough money to put in a second one. Then enough to put in a third one, and we are now using over 10,000 horsepower. A lot of people said that the process was not practical, and we could not do it, but we are doing it and are making money. We are going along and allowing the other fellow to say that it can not be done.

The CHAIRMAN. Where do you get your power?

Mr. SWANN. From the Alabama Power Co.

The CHAIRMAN. What does it cost you?

Mr. SWANN. Something over 6 mills a kilowatt-hour, which is around $36 a horsepower year. That is primary power, and we are negotiating with them for a large block of power from Mitchell Dam, their new development.

The CHAIRMAN. You are preparing to get a supply of secondary power there?

Mr. SWANN. To use secondary power only. We want to consider locating our fertilizer plant—that is, a small unit of one—at the dam and to take power directly from the generators through one transformer.

The CHAIRMAN. Your product is fertilizer, is it? Is that what you sell?

Mr. SWANN. At the present time, a large part of our output is ferro phosphorus and food grade phosphoric acid. I think I had better explain what I mean by food-grade acids. The great use of phosphoric acid is in the fertilizer industry. Roughly speaking, it would take some 600,000 horsepower to make the phosphoric acid that goes into fertilizer. Something like 25,000 to 30,000 horsepower would make the phosphoric acid for the food grade product. You would be surprised, perhaps, to know how many uses there are for phosphoric acid. If you had biscuits this morning, your baking powder was partially phosphoric acid. The selfrising flour that we use so much in the South has a certain amount of calcium acid phosphate, which is merely lime mixed with phosphoric acid. In the manufacture of hydrogen peroxide phosphoric acid is used. If you happen to drink soft drinks, there is some phosphoric acid in most of them. If you go to a soda fountain and order an orange phosphate the boy will take up a bottle and give it a few shakes. That is phosphoric acid. The sugar you use has been clarified with phosphoric acid.

The CHAIRMAN. Who are your customers, to whom you sell your product?

Mr. SWANN. We sell to the sugar refiners, the baking-powder manufacturers, the soft-drink manufacturers, the peroxide manufacturers, yeast manufacturers, and to the medicinal trade.

The CHAIRMAN. Do you sell to the fertilizer companies?

Mr. SWANN. We have sold what fertilizer we have made directly to large fertilizer manufacturers because we did not have the organization to distribute it at the time.

The CHAIRMAN. From what source do you get, of these various things that you have mentioned, your largest revenue?

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Mr. SWANN. We get our largest revenue from the higher priced acids, known as food grade.

Senator MCKINLEY. What did you say then?

Mr. SWANN. Food grade; that is, phosphoric acid used for food purposes. The reason they like our acid better than they do that produced by the old method is because of the high degree of purity. Phosphoric acid is ordinarily made by acidulating or treating phosphate rock or bone with sulphuric acid. This method produces a weak solution that must be concentrated and in which many of the impurities remain. We start in with a solution five or six times stronger than the one by the old method, and the larger part of the impurities go out in the slag. The only impurities we can get in our acid are those that go over in the gas, and for this reason it is particularly adapted to food grade purposes that call for low impurities. For instance, the pure food law requires that arsenic must be less than 1.43 parts per million.

I think there is one brief statement that I can make that will size the whole situation up:

How much power does it take to make a ton of acid phosphate? Then you can compare that with the sulphuric acid method and there is the whole basis. In the first place, no one had ever developed a furnace that was a success over a period of time. We have had some seven or eight different types of furnaces. I suppose we have spent at least $200,000 in constructing and reconstructing furnaces alone to find the correct design, to find the correct design of a furnace. There are a lot of technical details that I won't bother you with. It is just like the new ammonia process at plant No. 1, that did not quite work. I think eventually a cheap process for synthetic ammonia will be worked out. It perhaps will call for more experimentation than has been used in connection with phosphoric acid, but I am of the opinion that it will be worked out.

We wanted to develop this process commercially. We wanted to be sure, and have now gotten to the point where we know exactly how to do it. I will say frankly that what we term "condensation" is something that happened accidentally, but we finally learned how to control it. We did not know, but we simply kept looking until we found out what it was. The first step was to develop a furnace. The next step is to properly operate the furnace. I will say to you, gentlemen, that an electric furnace is as sensitive as a dyspeptic to what you feed it. We know that by sad experience. You put in a certain size of phosphate rock and you will not get results. If you have too large a quantity of fines you won't get good results. On the other hand if you put coarse coke in you will have lots of trouble. It must be coke braize, which happens to be the cheapest form of coke. We did not find that out for a long time. We tried lump coke and it did not do right; then nut coke, and finally coke braize. There are a great many of these points, and I could spend a week telling you what not to do with an electric furnace, and I could put down on a sheet of paper the things that we know how to do. It is still in its infancy; we have just started. I watched our power consumption and I wanted to find out, having been a power man, the kilowatt-hours per pound of phosphoric acid. A great many of your witnesses have spoken of it in the term "per horsepower year," but it can all be computed back to the common rate of exchange. I have watched our power consumption go down month by month, and our recovery go up. By recovery I mean that we buy from the phosphate rock miners so many tons of phosphate rock that contain so many pounds of phosphoric acid, and we ship out so many pounds of material that contains so many pounds of phosphoric acid. The difference between that we buy and sell is the recovery. For a while it was low. I will say this, that if the recovery is satisfactory phosphoric acid can be made in the electric furnace which has been developed, and that three furnaces are operating now and making high grade phosphoric acid cheaper than it is now being made by the old sulphuric acid process.

The class of power naturally plays an important part in this element of fertilizer material, but fortunately the investment in plant to make phosphoric acid is low. Therefore you can afford to have your plant stand idle a longer period of the year than you could if your capital cost was high.

The CHAIRMAN. What about the labor?

Mr. SWANN. The labor is comparatively small and will be reduced by further use of labor-saving devices.

The CHAIRMAN. You would not lose your labor organization, then?

Mr. SWANN. No. We expect, ourselves, to use a certain amount of secondary power. The question of secondary power is a very important one. If you have a lot of power and can not afford to turn it all into primary power, then the thing to do is to find out how you can use it as secondary power most economically and make the greatest profit on it.

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I believe that time will prove that the manufacture of phosphoric acid by this method is the keynote to the fertilizer industry. The reason for that is this: You take liquid phosphoric acid and fix gaseous ammonia from whatever source it is obtained, or take liquid phosphoric acid and treat phosphate rock and make concentrated acid phosphate, so that it serves a dual purpose.

Coming to the point of how the farmer is going to use it, I want to say that I have great respect for the intelligence of the farmer, and I believe that when you show him that he can get something concentrated and dilute it himself at a lower price, that he will use it.

Now, take the question of the filler in fertilizer. There is a filler in the fertilizer, not because the manufacturer wants to deliberately put the filler in, but by virtue of the process that he uses in making it the filler is there. To repeat, he takes his phosphate rock, gets 16 per cent phosphoric acid, and the other 84 per cent is inert material. He takes sulphuric acid, fixes the ammonium gas from the by-product coke over, or from any of the other processes, and he gets 25 per cent plant-food material, the other 75 per cent being inert material. There is no necessity for that, and if the farmer is a dirt farmer he surely would have enough dirt on his place to mix with this concentrated fertilizer, and that is all that it amounts to, dilution——

Senator HEFLIN. And teaching him how to mix it, of course.

Mr. SWANN. Yes. I will say this, that I do not believe the average farmer will buy acid phosphate from one manufacturer, sulphate of ammonia from another, and potash from still another and then attempt to mix these together. However, when you give him something that all he has got to do is dilute it, he is going to buy it, provided he can save money.

I am making up a considerable quantity of concentrated mixed fertilizer and will send it to every experimental station and farm organization in the United States, for test purposes. The directions will say "Mix this sack with four sacks of dry dirt or dry sand." The problem is dilution, not a chemical problem of mixture or a scientific problem that calls for any great skill. You may naturally say, how far will he go to mix it? Let us suppose that the average small farmer did not mix it. Then what will you do? How are you going to cheapen the cost of fertilizer? That, I understand, is really the problem that this committee is concerned with. You are going to cheapen the cost of fertilizer by using phosphate rock as near the mine as possible, and very fortunately Muscle Shoals is well located with respect to phosphate rock; then you are going to ship to distributing points in the most concentrated form, and if you will ask some of the fertilizer manufacturers the percentage of the total cost represented by freight bags and handling you will be astonished. This can be greatly reduced by use of concentrated plant food.

I think the large users of fertilizer will buy concentrated mixed fertilizers and dilute it themselves. What the farmer wants to buy is plant food, not some particular brand of fertilizer known as the "Black Crow" or the "Green Goose" or something of that kind. He wants a fertilizer containing, for his particular crop, as much of the three elements of plant food as he needs. That is what he is interested in.

Senator NORBECK. Some people are quite partial to patent medicine labels. Is that true with fertilizer labels?

Mr. SWANN. Yes, sir; but they will get over that. It may be a slow process, but it will come, and then the farm associations and others will have simple little mixing plants and buy a carload of concentrated mixed fertilizers and dilute for use in their immediate neighborhood.

That is perhaps the logical way in which it is going to work out. I do not believe all the farmers will buy it. I might say, by way of illustration, that the ordinary grade of phosphoric acid is sold as 50 per cent. We started selling 75 per cent, because we had to dilute it from 90 per cent, and I know that some of the manufacturers would not buy the 75 per cent and we have had to add water to dilute it to the grade they had been using. I have said to a number of them, "You have water around your plant; why don't you put some in and save the freight on water? That is all we do." It was new to them; they did not know the technical side and did not realize how simple it was. I think a campaign of education will correct this.

Very fortunately this process is worked out now. We know the unit of power that is required, and that you can make fertilizer and deliver it to the farmer cheaper than it is now being delivered and at a profit. I mean that our cost of manufacture is less than the old method. I think we could very properly say the "obsolete" method. It is true there are very heavy investments in acid phosphate plants and sulphuric acid plants throughout the country, but like everything else in progress, when there is a development which makes a process obsolete it must be replaced. It is rather unfortunate for the manufacturers who own these plants, but nevertheless progress demands that the cheapest process be used.

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Senator NORBECK. I would like to ask a question right here to get your viewpoint in regard to the relation of cheap power to cheap fertilizer in a little more concise form, if you can state it.

For instance, if you reduce the cost of power from 10 mills to 1 mill, what effect would that have on the cost of fertilizer by the present method and then by the method that you speak of? In other words, is power a large or comparatively a small factor in the cost of fertilizer?

Mr. SWANN. Roughly speaking 100,000 horsepower would make of the phosphoric acid content from 1,250,000 to 1,500,000 tons of mixed fertilizer of the grade now used. If you reduce the price from say $25 a horsepower year to $10 a horsepower year you would reduce the cost $15 per horsepower or a million and a half dollars from the total power bill which enters into the cost of the phosphoric acid or about $1 a ton of mixed fertilizer.

Senator NORBECK. About $1 a ton?

Mr. SWANN. For the phosphate element alone.

Senator NORBECK. What would that reduce the ordinary commercial fertilizer per ton?

Mr. SWANN. As I say, about $1 a ton.

Senator NORBECK. And fertilizer to-day is around $40 to $50 per ton?

The CHAIRMAN. Senator, he is speaking of only one ingredient there. He is not speaking of the nitrate or the potash.

Senator NORBECK. Will you apply that to the commercial fertilizer as it is now sold——

Mr. SWANN. The greatest advantage that you are going to get from concentrated phosphoric acid comes from the elimination of the sulphuric acid in the fixing of the ammonia.

Senator NORBECK. Speaking of the new process?

Mr. SWANN. Yes, whatever the cost of the ammonia may be; and I think you gentlemen can rest assured that ammonia is going to be produced cheaper than it is being made to-day. New processes are going to be worked out and old ones improved.

Senator NORBECK. Let me put my question in another way. Will the reduction come through the different process, rather than through simply the cheapening of power?

Mr. SWANN. Why, the cheapening of power bears just exactly the ratio to the cost as the amount that the power bill is reduced.

Senator NORBECK. But the thing I haven't been able to get, even under the present method, is whether the power is 10 per cent or 25 per cent of the cost, and therefore I don't know how much cheap power will reduce the cost of fertilizer. I have not been able to get that information at this hearing. I have not been able to get anybody to see, if he can reduce the cost of power from 10 mills to 1 mill, how much that would cheapen the commercial fertilizer per ton?

Mr. SWANN. I will say that our power represents from 20 to 25 per cent of our total cost to-day. There is a direct statement for you.

Senator NORBECK. Then if you reduce the cost of power one half you reduce the cost of fertilizer 12½ per cent?

Mr. SWANN. Yes, sir.

The CHAIRMAN. Now, Mr. Swann, how cheap, by your electrical-furnace method, would you have to have your power per kilowatt hour in order to produce phosphate at the same price it costs now in making fertilizer?

Mr. SWANN. Now, Senator, I am not trying to avoid that answer, but it is difficult to make a comparison, because we make a different product, a higher concentrated product.

The CHAIRMAN. You understand the importance of the question?

Mr. SWANN. I see the importance of it, and I am going to try to answer it for you.

The CHAIRMAN. If you will.

Mr. SWANN. Power at two mills per kilowatt hour is an estimate that I have used in working up the cost of a fairly large unit.

Senator NORBECK. How much?

Mr. SWANN. Two mills per kilowatt hour, which, roughly speaking, is about $12 per horsepower year. There are 6,535 kilowatt hours in a horsepower year. But, as you all know, the furnace does not operate every minute of the time, and 6,000 kilowatt hours is generally considered good practice out of the 6,535, so that at 2 mills 6,000 kilowatt hours is $12 per horsepower per year, and fertilizer can be made, per unit of phosphoric acid, at a cost considerably under the lowest cost that I have been able to find that acid phosphate is being made for to-day. You have only started with your advantages, and that is why I hesitated in answering that, because the fertilizer made to-day that you are comparing with ours, is 16 per cent, and ours would be 48

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per cent. Now, you would have one ton to pay freight on instead of three tons. I have said that the freight paid on sulphate of ammonia in the Birmingham district from the by-product coke ovens and the cost of sulphuric acid amounted to such a large sum that you could operate the phosphoric acid plant at a loss and make money. By this statement I mean that you could operate your phosphoric acid plant at a loss and you would save so much money in fixing the ammonia with phosphoric acid thus eliminating the use of the sulphuric acid and saving two-thirds on freight, that your total profit at the end of the operation would be substantial.

Senator NORBECK. You will pardon me if I ask the question over again, but I am not sure that I understood you and want to get it clear. When you said that power was 25 per cent of your cost I think you said it was power at 6 mills.

Mr. SWANN. Yes; and that was a small operation, comparatively, to the fertilizer——

Senator NORBECK. That cost applies to your finished product here, and not to commercial fertilizer as it is sold?

Mr. SWANN. That is it.

Senator NORBECK. All right. If you succeeded in reducing your cost $6 per ton it would be equivalent to $2 per ton in the case of fertilizer which has a lot of filler in it; is that it?

Mr. SWANN. If you reduce your cost—no, not $6. If you reduce your cost from $36 for power to $18 for power, power cost would be one-half and that would be reducing your total by 12½ per cent.

Senator NORBECK. And you are speaking of a concentrate that has three times the plant food in it that is in that ordinarily put out?

Mr. SWANN. Yes.

Senator NORBECK. And then you would put to that enough filler, in the form of something, to make three tons out of that?

Mr. SWANN. No; but in all my figures I have been attempting to go back to the ton of phosphoric acid in the finished product so as not to confuse you with these figures.

Senator NORBECK. Which is only one of the elements in the fertilizer.

Mr. SWANN. Only one of three, but which, by virtue of it being a liquid element and a saving having been made in the use of sulphuric acid and in the fixing of the ammonia element, and the saving in freight, is of great importance, greater than even the treatment of the power——

Senator NORBECK. I can see that very clearly, but what I am still trying to get is: What would free power do toward cheapening commercial fertilizer per ton, as the farmer puts it on his field?

Mr. SWANN. My direct answer was the difference between $10 power and $25, which would reduce the cost about $1 a ton.

Senator HEFLIN. In a ton of fertilizer, what proportion, in pounds, is the filler?

Mr. SWANN. The average fertilizer is about 15 per cent plant food, say 300 pounds and 1,700 pounds of filler.

Senator NORBECK. If we are to have cheap fertilizer, the answer is not simply cheap power, but you have got to find the answer in other ways of offsetting cheap power? Is that it?

Mr. SWANN. It certainly is true that cheap power bears just the relation that the cost of power bears to the total cost.

Senator NORBECK. Which is comparatively small, I take it?

Mr. SWANN. Yes, sir. With respect to the other savings that have been brought about, we find that with regard to a number of them, even with the price we are paying for power, we could never have operated if the cost of power had not been comparatively small. You understand that as a buyer of power I want my power just as cheap as possible, and that I can make a legitimate profit and sell my product cheaper as I get the power cost reduced. The point I want the committee to see, which is the common sense back of it, is that there are advantages in our process, which we have worked up and which are working that are very great——

The CHAIRMAN. Your processes are patented, I presume?

Mr. SWANN. Yes, sir.

The CHAIRMAN. Have you taken into consideration the Government plants, either one or both of them, at Muscle Shoals, in connection with the use of the process that you have developed?

Mr. SWANN. Mr. Chairman, I have been in Alabama since 1913. My thoughts have been about Muscle Shoals as much as any other one project. When I was sales manager of the Alabama Power Co. I did some of the original work on the commercial side of the development. Ever since starting in my own business in 1917 I have always had in mind that sooner or later I wanted to work out something that had to do with

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Muscle Shoals power. I started this company in a very small way. To repeat, I own control of it. I have not enough money to go into the fertilizer business on a large scale. All that I am trying to do is to work these processes out to such a commercial success, so there will be no question about it and make the process available on a very reasonable basis to the Government or to anyone that might get Muscle Shoals, and keep for ourselves the higher price food grade acid business.

The CHAIRMAN. Plant No. 2 is designed to produce a different element of fertilizer product, the nitrate part of it.

Mr. SWANN. Yes.

The CHAIRMAN. Would you be able, with your process, to utilize plant No. 2 without very extensive changes, to produce the phsophate part of it?

Mr. SWANN. The Government, in its estimate as to the utilization of the plant, when it was talking about operating it, called for a substantial investment to add a sulphuric acid plant to produce sulphate of ammonia. You would entirely eliminate this cost by utilizing our process for making phosphoric acid, because you would stop the cyanamid process at the point where you obtain ammonia gas and would fix ammonia gas with phosphoric acid and eliminate the cyanimid process from the point where the gas is produced.

The CHAIRMAN. It is about two-thirds through when it gets to that point, isn't it?

Mr. SWANN. Approximately.

The CHAIRMAN. How much additional machinery would they have to put in and how much machinery there now would be made useless?

Mr. SWANN. The machinery up to that point would be used.

The CHAIRMAN. Just as it is now?

Mr. SWANN. Yes; and the machinery from that point on would simply stand idle as a reserve, if the Government wanted it to.

The CHAIRMAN. In other words, the plant you have in mind would not interfere with the Government retaining plant No. 2 in a stand-by condition?

Mr. SWANN. Not at all.

The CHAIRMAN. To be used in case of war?

Mr. SWANN. Yes.

The CHAIRMAN. For the purpose of making explosives until at least they have reached a point where some cheaper method could be used?

Mr. SWANN. Until some other process is worked out and put into operation that would justify abandoning it?

The CHAIRMAN. Yes.

Mr. SWANN. As to the ammonia processes that you will eventually use, that is yet to be worked out and be made certain, you can not make sulphate of ammonia by the cyanamide process as cheaply as you can now buy sulphate of ammonia.

The CHAIRMAN. Then with respect to plant No. 1——

Mr. SWANN. Just the same thing. You could stop at the point where you get the gas, and fix the gas with phosphoric acid and produce ammonium phosphate.

The CHAIRMAN. That would cheapen it as compared with plant No. 2? How would that compare between plants 1 and 2, in cost?

Mr. SWANN. If we assume $15 is the cost of the suplhuric acid, and to fix a ton of sulphate of ammonia containing 500 pounds of ammonia, and if we assume 3 per cent of ammonia per ton of mixed fertilizer, that would be 60 pounds of ammonia, or a ton of sulphate of ammonia would supply ammonia for about 8 tons of mixed fertilizer. Therefore, your saving in sulphuric acid would be nearly $2 a ton.

The CHAIRMAN. As compared with what?

Mr. SWANN. As compared with the process suggested at the time the Government talked of operating Muscle Shoals for the production of sulphate of ammonia. This saving applies to any method of making sulphate of ammonia.

Senator MCKINLEY. Just to get it to a point where I can understand it—that $2 a ton, would that mean as compared with the Chilean nitrates?

Mr. SWANN. I referred to a comparison with the cost of sulphate of ammonia. Of course, in the final analysis you are concerned with a comparison in cost of the ammonia or nitrogen content. Of course, under the cyanamide process power becomes a tremendous item of the total cost. I believe the testimony of the Government experts here has been that with power at three-quarters of a mill per kilowatt-hour it would be rather difficult to compete with Chilean nitrates.

The CHAIRMAN. Yes; I think that is right.

Mr. SWANN. I do not know whether that included the cost of making it into sulphate of ammonia or not. Then if you reduce that by the cost of the sulphuric acid——

Senator MCKINLEY. I do not believe I got an answer that I understood. You say that you are going to save $2 a ton?

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Mr. SWANN. I do not know what the cost of the Chilean nitrate is as compared with the cost——

Senator MCKINLEY. It is perhaps $50 a ton.

Mr. SWANN. I believe Major Burns can give us that comparison.

Major BURNS. I did not hear the question.

Senator MCKINLEY. Mr. Swann stated that he could save $2 a ton by not using sulphuric acid.

Mr. SWANN. Yes.

Senator MCKINLEY. What would that mean in saving with fertilizer figured on the basis of what we know that the Chilean nitrates cast, say $50 a ton, comparing it with the Chilean nitrates?

Major BURNS. My own opinion is that you could not make ammonium sulphate at the No. 2 plant to-day and compete with the Chilean nitrate at the present market. I do not know whether that answers your question or not.

Senator MCKINLEY. At what price do you think they can make it per ton, and how would the price compare?

Major BURNS. My judgment is it would cost more to make ammonium sulphate at plant No. 2, when you include the power charges, than you could sell it for. Sulphate of ammonia is selling to-day somewhere in the neighborhood of $55 a ton, and if you include all charges you could not make ammonium sulphate at No. 2 plant for less than $60 per ton.

Mr. SWANN. Then if that $60 a ton is the correct figure, and the cost of the acid is $15—and that of course is subject to the cost of the sulphuric acid at the time—you could make it for the equivalent of $45 a ton.

Senator MCKINLEY. That would compete, all right, with the Chilean nitrate.

Mr. SWANN. You would have the added advantage of concentrated material to ship out. Instead of 25 per cent material, as they proposed to make, you would have 75 per cent of plant food to go out to the distributing points instead of 25 per cent, and if your freight rate, we will say, was $3 a ton, you would save the equivalent of two freight rates or $6 on a ton of material containing 75 per cent of plant food.

Senator HEFLIN. And the farmer to-day is paying freight on about 1,700 pounds out of a ton of stuff that hasn't any value as plant food?

Mr. SWANN. That is correct.

Senator NORBECK. In other words, the recent increase in freight rates added more to the cost of fertilizer than free power would reduce it under the cyanamid process?

Mr. SWANN. I haven't calculated that. Of course the freight rates made a tremendous increase in the cost of fertilizer and I believe you gentlemen will see that the freight rate is the outstanding important matter of this whole proposition.

The CHAIRMAN. As it is in almost everything else.

Mr. SWANN. It has the additional advantage that it can be diluted at or near the point where it is consumed. I think to-day, if you will permit me, although this sounds like I am boasting about my own process, that the outstanding feature in the whole fertilizer problem is the changed method of manufacturing of phosphoric acid, so that the phorphoric acid may be taken in liquid form and used to fix gaseous ammonia or to make a triple superphosphate and cheapen the total cost of your phosphoric acid.

The CHAIRMAN. At the present prices in a ton of completed fertilizer ready to put on the ground, which one of these three elements, nitrate, phosphorus, or potash, costs the most? Which is the most expensive?

Mr. SWANN. The nitrogen or ammonia is the more expensive per unit.

The CHAIRMAN. Which is next?

Mr. SWANN. I guess it is a toss-up between the potash and phosphorus.

Senator HEFLIN. If the farmer could get this fertilizer in liquid form, how would he apply it to the soil? Would he put it in a barrel and sprinkle it on the ground and plow it in?

Mr. SWANN. If you shipped it to him in this form he would dilute with water and sprinkle it on. The final product, I think, would be a salt, not unlike this [indicating] sample, containing 75 per cent plant food of the three elements, ammonia, phosphoric acid, and potash, and that if you would dump a sack of that into some sort of spraying tank on wheels and fill with water, to be regulated according to the amount desired and then sprayed on. That is for some crops. You understand I do not advocate that as a practice for everything, but I say it is coming for certain crops. I think Professor Whitney, Chief of the Bureau of Soils, testified along that line, too.

The CHAIRMAN. Your idea, as I understand it, is that the mixing of these three elements, these three plant foods, would be done at the factory?

Mr. SWANN. Yes.

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The CHAIRMAN. Then the mixing of it with the filler would be done at or near the farm where it is used?

Mr. SWANN. Yes, sir. The filler could be dirt.

The CHAIRMAN. Yes.

Senator KENDRICK. But in any case it serves no useful purpose, except in the method of distribution over the land?

Mr. SWANN. That is all. I think I could go a step further. In Europe they do not use much mixed fertilizer, such as we have in this country. They use more of the concentrated fertilizer applied directly to the soil, and they buy and mix their own or apply to the soil separately. I think we are slowly coming to that. The fertilizer manufacturers are advocating higher strength fertilizer through the National Fertilizer Association. Only recently we had two very prominent engineers from Norway visit this country and our plant with a view to seeing if they could get the right to use our process in Norway, with their cheap water power. They went from our plant to Florida to see if they could buy their phosphate rock and ship it by water to Norway and use their cheap power to make liquid phosphoric acid and fix the ammonia. They had in mind getting some of their ammonia from Germany in tank ferries, making it into complete fertilizer and shipping it back to this country, and in view of low ocean freight rates as compared to high rail rates it may be that they can compete at certain points in this country.

Senator NORBECK. Why is cheap power such an important element over there, when it is such a small element here?

Mr. SWANN. They get their ammonia there. also the potash, and they ship a concentrated form at such low freight rates. The freight rates problem again. Also cheap power is far more important in the production of ammonia by certain processes than in phosphoric acid because it requires more power.

Senator NORBECK. Yes.

Mr. SWANN. They can ship their phosphate rock from Florida and their finished product back here about as cheaply as we can ship the phosphate rock from Florida to our plant. It is a question of freight rates again. That brings us up to a problem of railroad rates. Utilize the waterways to carry fertilizers. We are coming to it. That is the real strategic point of Muscle Shoals. I think, without question, we will see the day when tank barges will bring ammonia liquor from St. Louis, Chicago, Pittsburgh, and other important by-product coke oven centers to Muscle Shoals, and it will be fixed there with liquid phosphoric acid into concentrated ammonium phosphate.

The CHAIRMAN. To do that they would come down the Ohio River to the mouth of the Tennessee?

Mr. SWANN. Yes.

The CHAIRMAN. And then up the Tennessee River?

Mr. SWANN. Yes, sir. Then, that same tank will carry back a load of finished products that will be made there by some one, so you will have a haul both ways, I do not think this is an idle dream. This is a practical proposition.

Senator HARRELD. You can ship your phosphate rock from Florida up there.

Mr. SWANN. You can do that also.

The CHAIRMAN. But that would be a very long haul, if you did not haul it by water, because the mouth of the Tennessee River is so far away, that you would have to travel that distance twice.

Mr. SWANN. That is quite true, but there is a considerable distance between here and Norway.

The CHAIRMAN. Yes.

Mr. SWANN. And there is the question of inland transportation.

Senator HEFLIN. But the water rates, even then, would be much cheaper.

Mr. SWANN. The use of our waterways is coming. I think we all agree on that. The details are an incident.

The CHAIRMAN. In talking with a Government official who was operating a boat on the Warrior River from New Orleans to the headwaters of the Warrior River, which is about 50 miles from Birmingham, I learned that the great difficulty, as he put it, was that there was a haul divided between the railroad and the waterway, and that the railroad took it all and did not leave anything for the boat.

Mr. SWANN. I think that is true, and if you had gone one step further he would have told you he did not have a haul both ways.

The CHAIRMAN. Well, he hauled some coal back.

Mr. SWANN. Oh, yes.

The CHAIRMAN. I remember distinctly the one item of coffee. Birmingham gets a great deal of coffee from New Orleans, and he hauled it something like 400 miles on his boat. I believe their rate from New Orleans to Birmingham was 48 cents a hundred.

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I think that is right, but I am speaking from memory only, and as long as the boat was on, the railroads put the rate down to 43 cents a hundred, and then they shipped coffee from New Orleans on the boat to within 50 miles of Birmingham, where they had it loaded onto freight cars and hauled to Birmingham; so that the railroad haul was 50 miles and the boat haul wasthe balance of the distance, several hundred miles, and the railroad got 38 cents out of the 43 cents, and the boat got 5 cents.

Mr. SWANN. No, Senator; the Warrior River Transportation Line can not show a profit operating on that basis, but that would be eliminated if it would come into Muscle Shoals.

The CHAIRMAN. Yes.

Mr. SWANN. You would have the entire haul?

The CHAIRMAN. Yes; but of course that is one of the things that must be regulated.

Mr. SWANN. Furthermore, you could distribute from Muscle Shoals by water a great tonnage of fertilizer. If you will just take a look at the map of the United States you will see the territory that could be serviced, especially when you not only reduce the bulk of your freight shipped, but also reduce the rate.

Now, from another standpoint, you are interested in Muscle Shoals and so am I, but you can make too much fertilizer at Muscle Shoals. You can concentrate the manufacture of too large a proportion of the total of the United States there. That will be governed by the amount of fertilizer used in the South. Slowly the Middle West and the far West will come to utilize fertilizer. This process is available to any other projects. However, Muscle Shoals, I think, can produce such a tonnage that it will be one of the controlling factors in the price of fertilizer, and with the concentration you can ship it out to territories that you can not ship to now. So there are many other projects in which there is some secondary power. You will notice that while I dwell upon secondary power I am looking for something to utilize secondary power because there is so much of it there and throughout the South. That is the basis on which I expect to be able to buy power from the Alabama Power Co.

Senator HARRELD. Most of the power in the South is secondary power, it is not?

Mr. SWANN. That is the truth about the situation. We have to have some steam plants to supplement the water powers. Of course, as you build reservoirs at the headwaters of the streams, that will be partly corrected, but I am a firm believer in the amount of power which is going to be used in the South and in the increased number of developments. Those developments are going to increase and multiply the amount of secondary power. Now, there must be some method of utilizing the secondary power from an economic standpoint.

Senator HEFLIN. You suggest that they might manufacture too much fertilizer there, Mr. Swann. Doctor Whitney, the Chief of the Bureau of Soils, testified here the other day that the farmers of the United States could, and he believed would, if they could get it at a reasonable price, use twice as much fertilizer as they have used.

Mr. SWANN. Senator, by that I mean that the cost of assembling and distribution from there would be too great, and that this process was available elsewhere. We should have been producing 10,500,000 tons instead of a maximum of 7,500,000 tons.

Senator HEFLIN. In 1920 it was nearly 8,000,000 tons, and in 1921 it had fallen off to a little over 4,000,000 tons.

Mr. SWANN. As I recall his testimony before the House Committee on Military Affairs, he testified that we should be using ten or twelve million tons now.

Senator NORBECK. Your position is this, that the farmers of the United States can be provided more cheaply with fertilizers by having a number of plants which are distributed than by attempting to do it all in one place, on account of the cost of transportation, and so forth?

Mr. SWANN. Yes; and as you work it successfully at one place, you will find other places to work it at.

Senator HEFLIN. How much can be produced at Muscle Shoals?

Mr. SWANN. That is a difficult question to answer, Senator. I should say from 1,500,000 to 2,500,000 tons. Of course, you will use a part of your power to make ammonia, a part to make phosphoric acid, and possibly a part to make potash.

Senator HEFLIN. By the use of that cheaper water power there do you not think it will do a great deal toward bringing down the price of fertilizer very materially as it is sold to the farmer?

Mr. SWANN. Yes; and what is going to bring it down, I think also, is the application of the new process, with all of the resultant savings along the line.

Senator KENDRICK. There seems to be a different kind of secondary power, graduated upon the length of time and the number of days in the year that it would be available. What would be the lowest number of days that you would consider economical to operate your plant?

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Mr. SWANN. I am now designing a plant for Mitchell Dam in which I am going to try to buy five and six and seven months' power; that will average six months.

Senator MCKINLEY. What would your organization do the rest of the time, Mr. Swann?

Mr. SWANN. My organization is going to be very small. I will make up and store phosphoric acid. We will keep a small organization running throughout the year, mixing the phosphoric acid with the other fertilizer elements, and you would be surprised to know how few men will be used in a plant of that type. I can go still further and say that I think we could keep those men on pay and it would be more profitable than using primary power.

The CHAIRMAN. What would these men do who only worked five months; what kind of men are they—are they highly skilled labor or otherwise?

Mr. SWANN. No, sir; about 85 per cent of our employees are the ordinary Alabama negroes.

The CHAIRMAN. Well, they would like to have a holiday for five or six months each year.

Mr. SWANN. But labor is not a serious item in the total cost under this process. We are now putting in a mechanical stoker that will feed our furnaces, and we are going to apply the old principle of granulation of slag, where we cast our slag out in water, and it is granulated, and use some more electric power to carry it away. That is all done by hand now.

Senator MCKINLEY. You are speaking of your process now?

Mr. SWANN. Yes, gentlemen; that is what I am up here to tell you about, what we have done on our process and what we know about it in its application to the other fields and the other elements of fertilizer, and I think I can say without egotism that we have done more on phosphoric acid than anyone else in the whole world. It is not much, but it is more than anyone else has done. We have done enough to prove that it is commercially successful.

Senator KENDRICK. The principal claim of merit that you make, or one of your principal claims of merit, is the elimination of this unnecessary filler, is it not?

Mr. SWANN. That is it.

Now, there is just one other thing that I have not dwelt upon, but regarding which Doctor Whitney testified, that is important, perhaps. The phosphate rock has been mined in Florida, and in that connection I want to make this statement. The Government, in some of its publications, states that for every ton of contained phosphoric acid shipped away from the mines there are two tons left on the banks, similar to the culm banks of the anthracite coal fields in Pennsylvania. In that material, washed out, there is a lot of silica. We can take the raw rock as mined and put it in an electric furnace and we will not need to buy the sand and put it in. There is a large saving in this item.

The CHAIRMAN. Let us get that again. I do not quite see the point there.

Mr. SWANN. To prepare the phosphate rock for shipment they wash it after mining. They wash out a lot of the finer phosphorus, small particles like this [indicating]. That goes away with what is termed the gangue. They do not want that silica, and they can not afford to have that silica present in large quantities, if they are going to treat the phosphate rock with sulphuric acid to make it available; but when we charge it into the electric furnace we have to add sand, or some form of silica.

The CHAIRMAN. So you want what they throw away?

Mr. SWANN. We will not wash out what they throw away.

The CHAIRMAN. Yes.

Mr. SWANN. This is just as simple as can be. This is one of the great features of the electric furnace, and will save considerable on raw material. We are very wasteful in our methods of using our raw materials, even though we have large quantities available. That is a wastful method, and you will find it referred to in several Government publications.

I am going to relate one more possibility, and will smile before I tell you about it, so you can smile afterwards, as it sounds like perpetual motion.

We obtain heat in the electric furnaces from the following sources: The electric power that we buy—the heat of the electric current; our means of smelting. We get some heat from the coke braize that goes in as a reducing agent. Nature gives up heat in the exothermic reaction of the carbon burning to carbon dioxide, and the phosphorus to phorphorus pentoxide. If any of you remember chemistry of your college days, you will recall the heat of the phosphorus burning to phosphorus pentoxide. There are four sources of heat. We lose heat in the radiation of the furnace and the gas mains; also that which goes out in the molten slag and ferrophosphorus which is tapped out, and there is left in the gases more heat than that which we buy as electric power.

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We are getting in our process very little of the total heat generated and acknowledge it. The gases in the mains range from 1,000° to 1,200° C. We cool the gases with air and water to about a hundred degrees in order to collect the phosphoric acid. We have utilized but little of the heat, and it is a shame to waste it, but a method will be found to utilize it. This will greatly reduce the cost of making phosphoric acid.

These are some of the possibilities in the future. "Why are you not doing it right away?" you say. Well, we have done considerably more than anybody else, perhaps, but we have only scratched the surface of the possibilities.

That all has to do with the cheapening of the cost of fertilizer, and right here I want to state that there should be and there must be, if the industry is going to continue, a fair and reasonable profit to the manufacturer who produces fertilizer, but the manufacturer should and must discard the obsolete methods and adopt the most modern methods. Instead of using 8,000,000 tons of fertilizer, you would be surprised at how many millions of tons could be used. It will be a great economic advantage to this country if more fertilizer is used.

I believe one of the witnesses stated that you can grow the same crop per acre with fertilizer and you can do it with one man working as you could with two men without fertilizer. You can paint a picture of this that sounds like a Utopian dream, but there is a whole lot of truth in it.

To go back for a moment, we produced phosphoric acid on a small scale first, then built a larger furnace, and could not duplicate our first results. It was heartbreaking, putting something into it day after day and not getting anything out, but we finally found the right temperature and the right this thing and that thing and the other thing. Any one of these things that I might mention would seem, even to a technical man, to be rather insignificant, but if you add them all together, they make the difference between a commercial success and one that is not. You might say, "Why have you stuck to this process?" Because we had to. We had a great big plant, nearly one-fourth as large as nitrate plant No. 2, with a capacity of 20,000 kilowatts, which is about 26,000 horsepower. We did not have anything for it to do. It was worth what we could scrap it for or what we could make it earn if we found something for it to do; so we had a prize of at least five or six hundred thousand dollars offered us to develop a commercial process. That is why we did it. Then, I was fortunate enough in having associated with me a large number of young men who did not know they could not do it, and they just kept plugging away.

Senator HEFLIN. Until they did do it?

Mr. SWANN. Yes; until they did do it. That is the strongest thing we have, our organization.

The CHAIRMAN. Now, Mr. Swann, I would like to get, if I can, in a sort of nutshell, the effect of your process upon the production of fertilizer.

Mr. SWANN. First, make a concentrated liquid phosphoric acid from phosphate rock; second, use that concentrated liquid phosphoric acid to either treat other phosphoric rock and make 48 per cent phosphoric acid as a salt three times the strength of the present method generally in use; third, use the liquid phosphoric acid to fix gaseous ammonia from any source, and save the cost of sulphuric acid; entirely eliminate the use of sulphuric acid in fertilizer, which is an inert material.

The CHAIRMAN. Now, I wish you would take those three things and give us the economy of each one of them as compared with the others.

Mr. SWANN. May I add one other there?

The CHAIRMAN. Certainly.

Mr. SWANN. Fourth, the resultant product of any of the mixtures will produce a fertilizer material running from three to five times the strength in plant food as the ordinary mixed fertilizers. There is the saving in freight, with all if the costs that go along with bagging, handling, and hauling and distribution.

The CHAIRMAN. Yes. Now, one great item involved in your process is the elimination of the high freight charges or any freight charges on unnecessary material. What other economies are involved in these four processes, or four stages of your process?

Mr. SWANN. In the making of the triple superphosphate you avoid the use of sulphuric acid, and you make the material three times as strong.

The CHAIRMAN. What I would like to do, Mr. Swann, if I can, so as to get it in a form so that we will understand it, so that an ordinary person will understand it, is to show just how much money will be saved by each one of these steps, if any, in the production of enough phosphate to make a ton of fertilizer, for instance. We are anxious to know, if we can find out definitely, just how much you cheapen the product.

Mr. SWANN. Senator, that is not a question that can be answered without putting so many "ifs" in it that the answer would not amount to much, for this reason: You have to know the freight rate on your finished material from the point where you are

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going to manufacture to where you are going to ship. You have to know the cost of sulphuric acid used in fixing a ton of sulphate of ammonia, and that varies in different section s of the country. You have to know the cost of the phosphate rock delivered to point at which you are going to manufacture. There again the freight rate comes in and plays an important part. We can get phosphate rock from the Tennessee mines for $3.08 a gross ton, and it costs over $5 a ton from Florida.

The CHAIRMAN. Well, of course, you would buy it from the Tennessee mines.

Mr. SWANN. You can work that out by setting up one location with one freight rate and one location or several with an average, with the points where you are going to distribute.

The CHAIRMAN. Let us take Muscle Shoals.

Mr. SWANN. And then take your cost of rock and sulphuric acid and distribution.

The CHAIRMAN. Suppose the location is Muscle Shoals. The freight which you would pay under your process in shipping rock from Tennessee there would be exactly the same as under any other process? That would be exactly the same as under present conditions?

Mr. SWANN. We are working on this question now, to apply to the Mitchell Dam, but assume that we are going to make it by two processes. The Norwegians asked that very question that you have asked. To give you anything of real importance would require a lot of calculations, but I can give you the broader aspects of your concentrated fertilizer material and saving in freight rate, and I think it is very evident there is a saving.

The CHAIRMAN. Yes.

Mr. SWANN. Now, when you come down to the final analysis, the cost of phosphate rock is going to be the same. I can analyze that part of it for you. It is not that I do not want to give it to you, but I want to give you a statement that will mean something and not have so many generalities in it, which destroy the effect. The rock will cost you the same delivered to Muscle Shoals, irrespective of the process. Now the thing we want to know is whether it will cost more for sulphur acid to acidulate phosphate rock than it will cost by electric power for operating the furnace.

The CHAIRMAN. What I am anxious to know is, by the utilization of your process how much that will cheapen fertilizer to the farmer as compared with what he has to pay for it now. You have told us very plainly, and I think it is quite plain to all of us, that one great item that would be saved would be freight, because it would be shipped in a concentrated form. Now, what is the reason that the present manufacturers can not ship these three necessary ingredients of fertilizer and mix them close to the place?

Mr. SWANN. I am glad you asked that question, because, under the present method, the best they can do, at a reasonable cost, is to make 16 per cent acid phosphate. We make 48 per cent.

The CHAIRMAN. So they can not do it in as concentrated form?

Mr. SWANN. The best they can do with sulphate of ammonia is 25 per cent, so the greatest amount of plant food in a ton is 25 per cent. We can easily ship 75 per cent. That is the real answer.

The CHAIRMAN. Yes.

Mr. SWANN. The elimination of sulphuric acid, which makes a dilute material, by the fact that you have used it.

The CHAIRMAN. The sulphuric acid itself is of no value as a fertilizer?

Mr. SWANN. Quite the contrary; too much of it sours the soil and is a detriment.

The CHAIRMAN. Yes.

Mr. SWANN. But, to answer your question, I have done a great deal of figuring on it because I thought I would be asked this question. I think, conservatively, you can say that you will make by this process complete fertilizers and deliver them to the farmer at at least one-fourth less than they are now being made for. I am talking about costs, eliminating all profit because, after all, there must be a profit on top of the cost.

The CHAIRMAN. Yes; of course there must be a profit.

Mr. SWANN. Now, the cost of your amonia has a great deal to do with the total cost, and that depends on the process used for producing amonia.

The CHAIRMAN. I do not know whether you have studied this question but, if you have, I want to get your viewpoint on this: Compare the cyanamid process of producing ammonia and the Haber process, as we have them down there, or not as we have the Haber process, because it is admitted to be incomplete, but supposing it was changed and remodeled in an up-to-date way.

Mr. SWANN. Senator, I do not pose as an expert on this question. My knowledge comes largely from association with men who know, and that is the most important point that we as a company have to decide, whose process is the best for us to join

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with, or to use for our phosphoric acid, because I think I have made it clear here that ammonia can more economically be fixed with phosphoric than sulphuric acid, and that the two are companions to each other.

Now, I do know that the cyanamid process is being abandoned in Europe, and that the Haber process, or the so-called modified Haber process, is going forward in tonnage much more rapidly than the other, and my own opinion, which is based upon information from my associates, and I have one very prominent consulting engineer advising me on this subject, is that unquestionably the cyanamid process is a back number, and that either the modified Haber process, the Claude, or some of the other processes will supersede it.

The CHAIRMAN. Now, applying that opinion to the work of this committee on the job that we have before us, would it result in this, that, as representing the Government, we ought to advocate the complete reorganization of nitrate plant No. 1, so that we could make ammonia according to the modified and most up-to-date system, and the holding of nitrate plant No. 2 in a stand-by condition purely and exclusively as a war proposition? Would that be the result of your judgment?

Mr. SWANN. If I myself controlled Muscle Shoals I would put in the modified Haber process for making my ammonia, and keep in a stand-by condition cyanamid plant No. 2, and operate it at such periods of the year as secondary power was available that could not be used otherwise, and if the cost of the ammonia in its finished form justified its operation, I certainly would keep the plant in a stand-by condition until such time as it was definitely proved that you could afford to scrap it.

Now, I think this, that the use of phosphoric acid to fix the gaseous ammonia may—there is a great big question mark after the word "may"—give the cyanamid process a little lease of life at Muscle Shoals by saving the cost of sulphuric acid, but eventually you are going to abandon it and use one of the other methods.

The CHAIRMAN. As a peace proposition, however much we might regret to reach the conclusion, do we have to reach the conclusion that we can not make fertilizer at plant No. 2 and be able to cheapen the product?

Mr. SWANN. That is my judgment. I do not think you can.

The CHAIRMAN. Of course, none of us want to reach that conclusion, but there is no use in lying to ourselves or in deceiving ourselves.

Mr. SWANN. I am afraid that that will be your final answer. I say that from the standpoint of Government investment.

The CHAIRMAN. The possibility of reducing the cost of fertilizer to the farmer rests on our ability to handle plant No. 2 and, if necessary, build another and a bigger one?

Mr. SWANN. Yes; and either fortunately or unfortunately, the farmer thinks he is going to get cheaper fertilizer.

The CHAIRMAN. Yes; and we ought to tell him the truth.

Senator HEFLIN. The way to get the fertilizer is to keep on fighting it, is not that true?

Mr. SWANN. Yes; and to go further than you have gone.

The CHAIRMAN. Oh, yes; we want to do that.

Mr. SWANN. When you have cheapened to cost of ammonia you have just started. You are dealing with 20 per cent of the total. Do not quit there; go on and finish the job. You can do it; the way is being pointed out here now.

The CHAIRMAN. I think so. I have not abandoned the hope at all of cheapened fertilizer. I think we are going to do that for the farmer, but first it looks to me, taking the judgment of the scientific men, that the road to travel is not along the cyanamid process of plant No. 2. The proposition was that we can do better by taking the modified Haber process, and I do not mean to be confined to plant No. 1, which is a comparatively small plant, as you know, as compared with plant No. 2; it is just a midget.

Mr. SWANN. Yes.

The CHAIRMAN. And if we can demonstrate there that we can produce it, then it is only a question of a very short time until we can erect a much larger plant, or several of them, for that matter, by the most modern methods.

Mr. SWANN. That is true, and that will likely be the result. Plant No. 2 has served its purpose. I do not consider the money lost.

The CHAIRMAN. Oh, no; and it may serve a great purpose still; in fact it will, even as an insurance proposition.

Mr. SWANN. As an insurance proposition. Both from the standpoint of war and peace, it is a good thing to have it in stand-by condition.

The CHAIRMAN. For the same reason that we build a battleship and do not use it in peace time.

Mr. SWANN. Yes.

The CHAIRMAN. It stands there like a battleship; it will be expensive to operate but when we are at war that expense will be a comparatively small thing.

Mr. SWANN. It will be incidental, yes, sir.

Senator HEFLIN. Well, it is claimed by some of the friends of Mr. Ford that he had a secret process by which he is to make fertilizer much cheaper than it is being made to-day and that, by the use of this cheaper water power at Muscle Shoals he will be able to produce it and sell it at half the cost that is entailed upon the farmer to-day by the big fertilizer concerns of the country. Do you think that is possible?

Mr. SWANN. Senator, I do not know what the process is.

Senator HEFLIN. Well, you have worked out a process of your own that is quite an improvement on what they have there.

Mr. SWANN. It would be a guess if I attempted to answer that. All I know is what we have actually accomplished, and I have told you a few things of what we hope to accomplish by conserving some of the power and by using cheap rock that has not been washed out.

Senator HEFLIN. As I understand it, it is your idea that in time this old process they are using now will be abandoned for another and cheaper process.

Mr. SWANN. I have said, since I started on this work, that whether I developed it or someone else, it was going to be developed, that the old method of treating phosphate rock with sulphuric acid had to go, and I believe if you pin the fertilizer manufacturer down he will acknowledge it.

Senator HEFLIN. Why are all of these old concerns fighting your method, and why would they fight anybody else's method that is likely to make fertilizer cheaper?

Mr. SWANN. I do not recall offhand the total investment in the sulphuric acid plants in the South alone, but, if my memory serves me right, there is over thirty million dollars invested in acid phosphate plants. I should say that this process will make obsolete, to be very conservative, a great many million dollars' worth of equipment.

The CHAIRMAN. That is, your process, you mean?

Mr. SWANN. Yes, sir. Naturally this process comes pretty hard to the firm which will lose its investment. If you were a stockholder in one of these companies you would not like an announcement that a new process had made obsolete your investment; and suppose you owned the bonds on the equipment which then would be junk?

Senator HEFLIN. They are really afraid that if Mr. Ford gets hold of that Muscle Shoals project he will make fertilizer so cheaply that he will get their business; is not that true?

Mr. SWANN. They see our process working the way it is, and I will tell you frankly, we would a great deal rather they did not believe it. We hoped they would take us as a joke. That would give us a little longer lease of life. I know that my testimony before the Military Affairs Committee of the House was impugned, and they took back-handed slaps at me, but it did not affect the situation as to what we were doing. It did not change the fact that we are making money.

Senator HEFLIN. Is it not a fact that these big commercial fertilizer concerns are opposed to anybody getting hold of that power down there if they are going to use it for making fertilizer in competition with them?

Mr. SWANN. When I was in New York, about three weeks ago, the president and vice president of one of the large fertilizer companies had lunch with me, and they expressed the greatest interest in our process. They wanted to know what sort of a proposition I could submit to them, to put up to their board of directors, and I think they realized that a new method was coming in and that they must adopt it.

Senator HEFLIN. They have been writing here to Members of Congress urging that we not accept the Ford offer. I wonder why that is.

Mr. SWANN. Propaganda, Senator, seems to be one of the great things, especially since the war.

The CHAIRMAN. Senator, while I am not charging it to Ford at all, as a matter of fact 95 per cent of what I get are from people who are for Ford.

Senator HEFLIN. Oh, yes; I get a great many letters——

The CHAIRMAN. Do you think that is propaganda?

Senator HEFLIN (continuing). From all over, urging us to accept Ford's offer.

The CHAIRMAN. Do you think that is propaganda?

Senator HEFLIN. Well, probably it is, but it is the right kind of propaganda.

The CHAIRMAN. Oh, that is the idea?

Senator HEFLIN. Because he agrees to do something that will benefit millions of farmers.

The CHAIRMAN. Yes.

Senator HEFLIN. And he is going to use something that is now going to waste, that is, the power at Muscle Shoals, while the other fellows are trying to keep the farmers from getting this benefit, and want that plant there to lie idle.

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The CHAIRMAN. That does not apply to me?

Senator HEFLIN. Oh, no.

The CHAIRMAN. And it does not apply to the mail that I get, because I have a proposition that would utilize it all, if my dream should come true.

Senator HEFLIN. Oh, yes.

The CHAIRMAN. Even to a greater extent than Ford proposes in his offer, and yet the mail that I get in regard to the bill that I favor as compared with what Ford is making is about 95 to 1. I have not paid any attention to either one of them. I think I know more about it than 90 per cent of the fellows that are writing to me. I may be wrong about it, but I am inclined to think that I do, and I am going to decide it on my own judgment, and not on theirs, whether I am right or wrong.

Senator HEFLIN. I was mentioning particularly these fellows who are now making the fertilizers and who control the prices absolutely. The farmer has nothing on earth to do with it.

Mr. SWANN. Senator, if I may say so, if they have been controlling the price of fertilizer recently, I would not want them to control the price of anything that I make, because they have lost more money than any other one industry that I know of.

Senator HEFLIN. Yes; they have lost money since 1921, the beginning of 1921, but that was because of the deflation policy and the purchasing power of the farmer, etc.

The CHAIRMAN. I suppose it is like a great many other things; it applies more to the farmer than to any other class of people in the world. A great part of their loss recently has come about on account of the unreasonable freight. Freight is a big item in the fertilizer proposition. It makes it very high—so high that the farmer can not buy it.

Mr. SWANN. Freight is the big thing. Freight stares you in the face anywhere you go.

Senator HEFLIN. You had this situation: In 1919 the farmer used a big supply of fertilizer and he got a good price for his products. In 1920 he bought a larger supply of fertilizer than he did in 1919, and his prices were good when he bought it; but when he came to pay for it deflation was on in all of its fury, and he could not pay for it. The fertilizer people did lose some money then, in 1921. The farmer said, "No; I am not able to buy this stuff; I do not get anything for what I am making," and he cut his supply of fertilizer in half. That is why they were hurt there, but in normal times they could get good prices for it. The farmer pays too much for it.

Mr. SWANN. The farmer pays too much for fertilizer because of the method of manufacture more than the percentage of profit that the fertilizer manufacturers make. I think, if you will dig right down into the facts back of it, the total profit made by the fertilizer manufacturer is not so great, but it is his method of manufacture, it is his cost of distribution; and the way in which he handles it; it is his credit loss and carrying charge, and all those things added together. It is really a very undesirable business to have your money invested in.

Senator HEFLIN. And the farmer pays for it all?

Mr. SWANN. In the final analysis, yes; but the other fellow does not make out of it what he is entitled to make, and what we want to do is to change a lot of these methods so fertilizer may be sold to the farmer at a cheaper price and leave a fair profit to the manufacturer.

Senator HEFLIN. That is what we are working for.

The CHAIRMAN. Now, is there anything else Mr. Swann, that you can think of that you would like to tell us about?

Mr. SWANN. I hope my statement here will not subject me to the same criticism to which I was subjected when I was before the House committee, that I was trying to straddle the fence as between Mr. Ford and the Alabama Power Co., because I am not trying to straddle any fence. I am here as the one manufacturer who is doing this on a large scale, to give you the benefit of our experience.

The CHAIRMAN. You have not any interest in this, outside of what you have already disclosed?

Mr. SWANN. No, sir.

The CHAIRMAN. Of course, you have a system that you want to have used, and that is a very laudable ambition; but have you any interest in the Alabama Power Co.?

Mr. SWANN. I have not a dollar's interest in the Alabama Power Co.

The CHAIRMAN. Have you any interest in these town lots that are laid out along the Tennessee River from Chattanooga to Florence?

Mr. SWANN. I would rather shoot craps to make money than to try to make it in that way.

The CHAIRMAN. You think you would stand a better show?

Mr. SWANN. I think so. My one interest and only interest is to try to make a reasonable amount of money out of having this process used, and it is available to the Government.

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The CHAIRMAN. That is what I want.

Mr. SWANN. Or to Mr. Ford or to anyone.

The CHAIRMAN. You are ready to let anybody use it on reasonable terms, and you are willing to supply it to anyone who gets the Muscle Shoals project?

Mr. SWANN. Not only at Muscle Shoals but elsewhere in the country where it is needed, and when I say "reasonable" I mean very reasonable. As far as whom I am for, to be perfectly frank, I am for Theodore Swann, which, in turn means the Federal Phosphorus Co., which I think I have a right to represent.

Senator HEFLIN. Well, you think you have done a good service in working out this proposition that you have?

Mr. SWANN. I think so. I believe so, and I think I am entitled to make some money on it.

Senator HEFLIN. Mr. Ford may take your process.

Mr. SWANN. Mr. Ford received word from me, through his representatives, months ago, that he could use this process if he wanted to, that he could send his men to our plant and train them; that he could send his engineers there, on a basis which the representative thought whom I told about it, was very reasonable. In fact, I merely asked to get a block of power, say, 10,000 of primary and 15,000 of secondary, at about what he pays the Government for it, to utilize in my high grade process to make my product cheaper. If the Alabama Power Co. should get it and that power is available, and the Government operates the fertilizer plant, they can have it on a reasonable basis. If some individual takes it over, he can have it. I say to you frankly that we have tried to avoid publicity. Up to the present time we did not care for the people to know, in fact, what we were doing; I mean by that our competitors.

Senator HEFLIN. And now, since you have made good——

Mr. SWANN. In fact, I owed so much money that I did not want some of them fighting me. Very fortunately I just borrowed a large sum of money last week, and am all fixed up now. I am in good shape now and do not mind starting a little rumpus if I have to.

I might tell the committee this further, to be frank with them, that I got the money from the Alabama Power Co. I owed them a lot of money, and they funded my debt in three to 10 year notes, money that I had gradually lost in developing this process, but that does not mean that there are any strings tied to me whatever. It is not a question of neutrality but one of absolute independence, because I think you know that this had to be a company developed by some one man largely, and the associates that I have at Anniston are the ones that are responsible for its success.

The CHAIRMAN. Anniston is a suburb of Birmingham, is it not?

Mr. SWANN. It is 64 miles away from Birmingham.

The CHAIRMAN. In its boom days it was a suburb of Birmingham?

Mr. SWANN. Possibly, but the Anniston citizens would not like that. In fact, they rather kid me for saying that I am from Birmingham. I live in Birmingham, but I have my business in Anniston.

The CHAIRMAN. Which way is Anniston from Birmingham?

Mr. SWANN. East, towards Atlanta.

The CHAIRMAN. And how far are you from Atlanta?

Mr. SWANN. About 100 miles.

Senator HEFLIN. Anniston is a good city in itself.

Mr. SWANN. A good city.

Senator HEFLIN. Yes.

Mr. SWANN. It has a splendid labor market, and is a good town to live in.

The CHAIRMAN. You are not on any stream, are you?

Mr. SWANN. Oh, no; the Alabama Power Co. supplied the power from their dam 75 miles distant.

The CHAIRMAN. How far would it be from this Mitchell Dam that they are constructing now?

Mr. SWANN. That will be about 90 miles, but I propose to possibly locate at Mitchell Dam.

The CHAIRMAN. Oh, you are going to put up your plant right there?

Mr. SWANN. Yes; we are considering this location.

The CHAIRMAN. On what river is that?

Mr. SWANN. That is the Coosa River.

The CHAIRMAN. Which way from Birmingham?

Mr. SWANN. South.

The CHAIRMAN. The Warrior——

Mr. SWANN. Is west.

The CHAIRMAN. The Warrior is west?

Mr. SWANN. Yes.

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The CHAIRMAN. That does not go into the Coosa River, does it?

Mr. SWANN. No, sir; that goes in the Tombigbee.

The CHAIRMAN. Yes. There is no power on the Warrior River there, is there?

Mr. SWANN. Why, the Government has some power there for a part of the year at Lock 17.

The CHAIRMAN. Was not that constructed as a navigation problem?

Mr. SWANN. That was constructed as a navigation problem, entirely, and I should not be surprised if power from that should be used with this very process.

The CHAIRMAN. How high is that dam?

Mr. SWANN. I am not certain, but I think about 60 feet.

The CHAIRMAN. I have never seen it, but I should think there should be——

Mr. SWANN. For part of the year there is a reasonable amount of power.

The CHAIRMAN. That river is navigable the entire year, is it not?

Mr. SWANN. Yes; since that series of dams built there.

The CHAIRMAN. I wonder why it was that power possibilities were not considered when these improvements were made by the Government?

Mr. SWANN. I do not know, unless it is that there was difficulty in the Government developing and selling the power, but it is there and available. A turbine and a generator can be put in.

The CHAIRMAN. I should think there ought to be considerable power developed there.

Mr. SWANN. Yes.

The CHAIRMAN. We have no further witness for to-day and we will adjourn now until to-morrow morning at 10.30 o'clock.

We are very much obliged to you, Mr. Swann. I was very much interested in your testimony.

Mr. SWANN. Thank you.

(A summary of the testimony of Mr. Gray Silver before the Committee on Agriculture and Forestry, May 9, 1922, is here printed in full, as follows:)

SUMMARY OF STATEMENT BEFORE SENATE COMMITTEE ON AGRICULTURE.

Mr. Chairman, owing to the interruptions and discussions during the taking of testimony I crave your indulgence to permit me to add a summary in order that the reader may get more clearly the full import of the testimony.

The farming population of our country is experiencing the most unhappy conditions ever known to many of our people, partly because of the war conditions and partly because of the postwar deflation, and now the war being over it is gradually readjusting itself. There has, however, grown up in this country, principally during the last 20 years, a business system which has discriminated against the farmer until he gets as a return for his activity, according to the report of the Joint Commission on Agricultural Inquiry, only about one-third of the consumer's dollar. In the application of this business system we consistently find that every opportunity is taken advantage of to maintain high prices for products of our industrial activities. These high prices on the materials consumed by the farmer in his production effort we refer to as high-cost factors and they must be lowered if the American farmer is to adequately and economically feed and clothe our people.

Among the many different methods used to maintain and build up these high-cost factors are abuses of the patent-rights system, and I used as illustrations the Selden case, the Gillette razor prices, and might also have cited the methods used by the United Shoe Machinery Co. which have put a most unreasonable charge against every user of shoes, all of which illustrate an abuse of the patent laws to maintain unreasonable high-cost factors; the methods by which the railways have been allowed to build up a basis for such burdensome charges against all-rail transportation, their short and long haul rates, and other discriminatory practices; the selling agreements of the steel pool, notably exemplified in the indefensible "Pittsburgh plus" method of determining prices for steel products, which practices are largely made possible by an unwarranted protective tariff; a copper pool acting under similar conditions and in a like way to make copper higher to the consumer in the United States than it is in any other country. There are other trade practices, trade secrets, secret formulas, secret processes, failure to use advanced methods even pigeonholing patented improvements that all result in taking an unjustifiable toll from the consuming public of this country.

There are three solutions to the Muscle Shoals problem. Completion and operation by the Government itself. Completion and operation by private interests on a plan that will maintain these high cost factors both in the power and in the fertilizer. Or you can approve of the proposal made by Mr. Ford and begin a new kind of industrial

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development based on low cost factors, develop power with low interest rates and best serve the people of the whole Nation by making available cheap power for industrial use and cheap high grade fertilizer for agricultural production. As an illustration of the use of cheap electric power in agriculture I would like to submit an article appearing in the Evening Star, March 20, 1922 [article attached]. In Sweden natural advantages give them electric water power at low rates. There is only one way to bring our own water powers as low as about $6 per horsepower year and that is through the low interest, amortization plan of financing proposed in Mr. Ford's tender.

So if Congress sees fit to accept the tender, made in good faith, you will put to work for the benefit of the public, the genius, money and training of this man on a basis that will take a great step forward toward freeing the consumers of the country from the unfair charges above mentioned. It would seem on the face of it that no one would hesitate but that a matter of so great importance to everyone would have prompt and favorable attention and action.

However, since this tender was made nearly a year ago, there has been a line up of opposing interests. Opposing it vigorously are those who have the viewpoint of the private interests seeking to maintain high cost factors, high interest rates and in maintaining present conditions. Opposing it also are those who believe in the Government itself completing and operating the development. Advocating the Ford proposal are those seeking relief from present conditions and who believe these problems can be worked out as private business under Government authorization and supervision.

I can readily understand why those of the large interests who are benefited by the present system oppose the doing of anything different, for they want to continue in the favorable position which they now occupy. I can understand why those who believe in Government ownership and direction should advocate the nationalization of the water powers, for we all realize that we are just on the threshold of great development of water-power resources for both power and navigation. I can also understand why the believers in individual initiative couple Government control or regulation and urge an immediate acceptance of this tender in order that this new method of development may be applied without delay. Now, of the three solutions there is but one at this time that can be quickly turned to the help and benefit of the distressed people of this land, and that is the development of this great water power by private initiative under Government regulation, for none but the selfish beneficiaries of the present system can claim that a continuation of the present conditions is beneficial. On the other hand, however much merit there may be in Government ownership and resulting administration, there is none that believes it possible at this time or for many years to come to secure from the people or from Congress a willingness to nationalize the water power, for to a great many minds the nationalization of the water power of this country would be a stepping stone to the nationalization of coal mines, railways, and other important and essential activities of our national life. So while the argument is on between these contending forces, the farmer remains discriminated against and is not given the relief to which he is entitled, the farmer's wife has not the comforts and advantages she is entitled to, the farmer's daughter who has been sent away to school is called home to serve with the unpaid labor on the farm, the son who is ready to be sent away to school is kept at home with the younger ones, and the whole family goes without the comforts of life, labor-saving devices, comfort-making equipment, and other things that rightly belong to them for the service they are rendering, and all of which is denied them because many of those who are authorized to act for them become more interested in protecting some existing thing or advancing some new theory than in applying the wholesome thing at hand for their relief.

MOST OF FARMERS IN SWEDEN UTILIZING ELECTRIC POWER—WATER PUMPED FOR CATTLE, TIMBER SAWED, THRESHING MACHINES DRIVEN BY THE SYSTEM—CANDLES HAVE ABOUT DISAPPEARED.

[By the Associated Press.]

STOCKHOLM, March 1.—Electricity has conquered one-third of the entire cultivated area of Sweden, according to the latest official reports.

If Sweden continues electrifying at the present rate it will only be a few years till almost the whole country will be run by electricity.

Most of the farms within the electrified area are now tapping the new source of energy, and nearly all the power used in the daily labor on these farms is derived from the high-power lines which span whole sections of the country.

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Large power stations deliver most of the electric energy used in the rural communities, but in many places the farmers themselves have installed turbines and built private power stations, harnessing for this purpose swift streams and small waterfalls on their own properties. Those enterprises, however, are generally cooperative.

A great deal of the most arduous farm labor is performed by electrically driven machinery at a cost far below the cost of machines propelled by steam or horsepower or of hand labor. Water is pumped for cattle by electricity, threshing machines are driven by electric current, timber is sawed by motor power, and farm hands are no longer ordered to cut firewood by hand, because it is cheaper to have even that labor done by electricity. Candles have almost disappeared.

In many cases grain is dried and cleared by being passed through electrically driven hot-air fanning machines. It is not uncommon to find on the larger estates electric elevators which lift entire wagon loads of hay or grain and dump them where desired in the barns.

One Swedish estate owner has installed an electrically operated irrigation system, whereby a large field can be watered in times of drought. It is now only a matter of a short time till plows and harrows will be propelled by electric power.

(Whereupon, at 12.40 o'clock p. m., the committee adjourned until to-morrow, Saturday, May 13, 1922, at 10.30 o'clock a. m.)

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MUSCLE SHOALS.

SATURDAY, MAY 13, 1922.

UNITED STATES SENATE,
COMMITTEE ON AGRICULTURE AND FORESTRY,
Washington, D. C.

The committee met, pursuant to adjournment, at 10.30 o'clock a. m., in the hearing room of the Committee on Commerce, Capitol Building, Senator George W. Norris presiding.

Present: Senators Norris (chairman), Ladd, Norbeck, McKinley, Harrison, and Heflin.

The CHAIRMAN. The committee will come to order, gentlemen. You may proceed with your statement, Mr. Merrill.

STATEMENT OF MR. O. C. MERRILL, EXECUTIVE SECRETARY OF THE FEDERAL POWER COMMISSION, WASHINGTON, D. C.

Mr. MERRILL. Mr. Chairman, how do you wish me to proceed this morning? Do you wish to ask me questions?

The CHAIRMAN. First, Mr. Merrill, let us get into the record who you are and your business, so that the record will show that. Then we will be glad to have you go ahead in your own way. You know what we are considering here.

Mr. MERRILL. Yes.

The CHAIRMAN. And as you go along, if you do not object, we will ask you questions as they occur to us, if there are any such questions that do occur to us.

Mr. MERRILL. My name is O. C. Merrill. I am executive secretary of the Federal Power Commission.

The CHAIRMAN. That Commission came about by the enactment of the act of June 10, 1920, did it?

Mr. MERRILL. Yes sir.

The CHAIRMAN. Providing for——

Mr. MERRILL. Providing for the creation of a commission composed of the Secretaries of War, of the Interior and of Agriculture, to whom was granted the authority for the issuance of licenses for power development on the navigable waters, public lands and international streams of the United States. This commission is operating under the terms of the Federal Water Power Act.

Senator MCKINLEY. Are you located here, Mr. Merrill?

Mr. MERRILL. Yes, sir; our offices are in the Interior Department Building.

The CHAIRMAN. Now, as a matter of fact, for practical purposes you are really the head of the commission, are you not?

Mr. MERRILL. I am the executive officer of the commission.

The CHAIRMAN. Of course, we all know that while official action is taken by these Cabinet officers, as a matter of fact they do not have the time to give any attention to the details, and that is what you do?

Mr. MERRILL. Yes.

The CHAIRMAN. So that all applications for the development of water power on any of the streams, as you have referred to, are passed on, as a matter of fact, first by you?

Mr. MERRILL. Yes; passed on by my office, and then referred to the commission with recommendations.

The CHAIRMAN. Yes.

Senator HEFLIN. You represent the Government in that capacity, do you, Mr. Merrill?

Mr. MERRILL. Yes.

The CHAIRMAN. Now, Mr. Merrill, as you know, we are considering the various offers that have been made and the two bills that are now pending here regarding Muscle Shoals. We want to get any information that you may have in regard to that

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power development down there, and if you know anything about the nitrate plant there, we would be glad to have any information you can give us in regard to the possibilities, and so forth.

Senator McKINLEY. Mr. Chairman, let me ask the witness this question first: What experience have you had, Mr. Merrill, in connection with water-power matters?

Mr. MERRILL. Before I came into the Government service I was in California, where for about two years I was engaged as an assistant to the consulting engineer of the Southern Pacific Co. in investigating water powers for purposes of railroad electrification in California, Oregon, and Washington.

The CHAIRMAN. And when you say "the Southern Pacific Co.," you mean the Southern Pacific Railway, do you?

Mr. MERRILL. Yes.

The CHAIRMAN. You are an engineer?

Mr. MERRILL. I am an engineer; yes, sir; a graduate of the Massachusetts Institute of Technology and a member of the American Society of Civil Engineers.

Senator McKINLEY. That is what I wanted to know.

Mr. MERRILL. In 1909 I came into the Forest Service. I went into that service from water-power work, and I have been engaged on water-power work for the Government ever since that time, which is nearly 13 years. During that time I was chief engineer of the Forest Service and in full charge of the administration of water powers in the national forests, prepared the regulations of the department, and prepared, in part, the measure that afterwards became the Federal water-power act. I was appointed executive secretary of this new commission when it was organized on July 1, 1920.

I might discuss briefly, Mr. Chairman, this question of the amount of water power down there, but I suppose you already have considerable of that in the record.

The CHAIRMAN. Yes; we have, but we would like to have your views on it also.

Mr. MERRILL. I went over Colonel Barden's testimony that he presented in the early part of the hearings, and as much of the balance of the testimony as I have been able to get hold of in typewritten form and read. We looked into the question of the amount of power available at Muscle Shoals pretty carefully last spring when I was requested to get certain information for the Secretary of Agriculture.

Of course, two individuals using the same data will not agree exactly, but these figures that I have here are very close to the ones that Colonel Barden gave you. They are in a little different form; that is all. I do not recall the exact figures he stated for Dam No. 2. Our figures show 74,600 horsepower, but that is for the lowest day in the 26 years of record that were used, and it does not, by any means, mean the amount that should properly be called primary power, because nobody ever thinks of developing power on the basis of having it there every day in the year for 25 or 30 years.

The figures that I have here include both Dam No. 2 and Dam No. 3, because they are both comprised in the Ford offer, and on the proposition that Dam No. 2 would develop 95 feet head, and Dam No. 3 would develop 40 feet head. This would give an absolute minimum at the two sites of about 106,000 horsepower.

There were two months, October and November, in 1904, which were the lowest on record for the 26 years of which we have a record. The figures of run-off for both of these months are in doubt. If they be disregarded, the primary power available for the lowest day outside of these two months, in the 26 years of record, is 79,200 horsepower at Dam No. 2 and 33,300 horsepower at Dam No. 3, or a total of 112,500 horsepower. If primary power be taken on the basis of the amount available 90 per cent of the time, the figures are: Dam No. 2, 123,000 horsepower: Dam No. 3, 52,000 horsepower; a total of 175,000 horsepower.

I have a diagram here,[1] if you care to examine it, showing, not the water discharges but the power available at the two sites. The portion of the diagram that is colored blue shows the amount of power available from water. If you will note the points where the dark green color extends down into the blue, you will see, represented by the dark green and compared with the total blue, the relative amount of steam power required to make all of the blue primary power and the periods during the several years of record when it would be necessary to operate steam plants to get the continuous output represented by the portion of the diagram colored blue.

There are approximately 130,000 horsepower in steam installation at nitrate plant No. 1, nitrate plant No. 2, and Gorgas. If that is used to fill in those depressions in the blue part of the chart, it is possible to get from the two dams and the steam plant 236,000 primary in combination. Each of the oblong blocks colored green on the diagram represents the 130,000 steam horsepower. A reference to the diagram shows

[1] The diagram referred to is on file with the clerk to the committee.

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that in only one year during the 26—namely, in 1904—would it have been necessary to operate the steam plants to capacity, and then only for a period of three months, in order to have made 236,000 horsepower continuously available. The longest period when it would have been necessary to supply auxiliary steam was for six months in 1914, but in none of these months would the full capacity have been required. Of the 236,000 horsepower years that would have been available from the combination of hydro and steam plants, 97 per cent would have been water power and only 3 per cent steam power. Seventy per cent of the water power would have been produced at Dam No. 2 and 30 per cent at Dam No. 3, so that——

Senator HEFLIN. Seventy per cent of that horsepower would be used——

Mr. MERRILL. Seventy per cent of the water horsepower.

Senator HEFLIN. Would be produced by Dam No. 2?

Mr. MERRILL. Would be produced by Dam No. 2, and 30 per cent of it by Dam No. 3. That is the approximate ratio. They both use the same amount of water. One will have a head of 95 feet, and the other a head of 40 feet, and the ratio of those two figures is approximately 7 to 3.

The CHAIRMAN. Do you not get more water from Dam No. 2 than you do from Dam No. 3?

Mr. MERRILL. Probably not; not an appreciable amount.

The CHAIRMAN. As I remember it, there is one quite large stream or river there that flows into the Tennessee between those two dams.

Mr. MERRILL. If so, it would make that amount of difference, but, as I understand it, the proportion you get from that stream is comparatively small. If there is any in there which is appreciable, it would make a slight difference in the ratio between these two. That is, with the two dams there, and with 130,000 horsepower of steam installation, you could get 236,000 horsepower of primary combination. That is continuous, 100 per cent, power.

The CHAIRMAN. Every day in the year?

Mr. MERRILL. Every day in the year.

The CHAIRMAN. Every day in every year?

Mr. MERRILL. Every day in every year, with the exception, I believe, of some 18 days in the 26-year period, which is too short a time to be worthy of consideration. That, of course, means it is not all water power. You are using periodically throughout this time some part of the 130,000 horsepower in steam to fill up the deficiency. The ratio, however, is as I have said only about 3 per cent steam out of the total, and about 97 per cent hydro.

The CHAIRMAN. That is on how much power?

Mr. MERRILL. Two hundred and thirty-six thousand primary combination from the two dams.

The CHAIRMAN. As I understand you, you mean you would get 236,000 horsepower, of which 97 per cent would be water horsepower, and 3 per cent would be steam?

Mr. MERRILL. Three per cent steam, although you would be using the steam plant now and then to nearly the full 130,000 capacity. There would have been four years, however, in the 26 when no steam at all would have been required.

The CHAIRMAN. Exactly.

Mr. MERRILL. Nevertheless, 3 per cent of the kilowatt hours would have been steam.

Senator MCKINLEY. Of course, Mr. Merrill, that is a misleading statement, because you have to keep the steam plant there ready?

Mr. MERRILL. The steam plant would have to be kept ready. There is a saving, though, in fuel. It is largely a fuel saving and some saving in general operation charges when the steam plant is not running. The major saving, however, is fuel.

Senator MCKINLEY. But your loss is in having to keep the steam investment and keeping it in shape?

Mr. MERRILL. You have all the time to carry the interest on your total steam investment and your depreciation on your total steam investment.

The CHAIRMAN. What investigation, if any, have you made in regard to the possibilities of increasing the primary water horsepower by the erection of storage dams in the upper Tennessee River?

Mr. MERRILL. I have not made any investigation of my own, Mr. Chairman. I am familiar, though, with the fact that the War Department has made and is now making investigations on the upper Tennessee River, with the idea of determining the possibilities of storing flood waters for the benefit of power and navigation. If that can be done, and to the extent that it can be done economically, will this site at Muscle Shoals be more favorable as a water-power proposition?

The CHAIRMAN. In your 240,000 horsepower—is it?

Mr. MERRILL. Two hundred and thirty-six thousand.

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The CHAIRMAN. In the 236,000 horsepower how much secondary power would there still be there that could be used eight months in the year?

Mr. MERRILL. That depends upon the installation, Mr. Chairman. The Ford offer proposes 600,000 horsepower at No. 2 and 250,000 horsepower at No. 3. That is a total of 850,000 horsepower of installation. Now, the amount of power that you can get from that installation depends, first, upon your load factor and, second, upon whether you have water enough to do it; but, assuming that you have enough water, you can get out of 850,000 horsepower installation on a 60 per cent load factor an average of only 510,000 horsepower. That is, 60 per cent of your installation as your average output. Whether you can get that average output there depends, however, on whether you have the water to keep it running all the time.

The CHAIRMAN. But the idea that I am trying to get at is that when we have gotten as much primary horsepower as we can get by the use of steam plants to assist in low periods, there would still be times in the year when there would be some secondary horsepower, if we could find any use for it, that is going to waste unless you do use it. I want to get the amount of that.

Mr. MERRILL. I have estimated that if 850,000 horsepower installation was put in, operating on a 60 per cent load factor 510,000 horsepower maximum daily average could be had, if you could use the water behind the dams for daily regulation. That would mean, then, that you could get, on account of the deficiencies in water supply, even with 130,000 horsepower steam, only 460,000 horsepower of all-the-year average—that is, 460,000 horsepower-years of electric energy with 850,000 horsepower of dydro installation. Now, everything above 236,000 horsepower-years is secondary. It can not be made primary even by the steam without adding to the existing installation.

The CHAIRMAN. Now, how much——

Mr. MERRILL. That would be 224,000 horsepower years of secondary power. The average daily output with 850,000 horsepower of hydro installation and 130,000 horsepower of steam installation, operating on a 60 per cent load factor, would vary from a minimum daily overage of 236,000 horsepower to a maximum daily average of 510,000 horsepower. For some 64 per cent of the time the 510,000 horsepower would have been available; for the remaining 36 per cent, a less amount. This secondary power of 510,000 less 236,000, or 274,000, which would have been available 64 per cent of the time during the 26 years of record would have produced an average annual output of 224,000 horsepower years.

Senator MCKINLEY. That would be eight months.

Mr. MERRILL. Nearly eight months, and that would mean an output, assuming that there is enough storage at the dams to regulate day by day the variations during the day, of about three billion kilowatt hours. If you can not use the pondage (which is the term ordinarily employed to designate storage used for daily regulation) to regulate for the daily load factor so as to use completely the water that is flowing by on any particular day, then these three billion kilowatt hours must be reduced accordingly. If you could regulate to only 80 per cent of use of the daily water supply you could get 2,400,000,000 kilowatt hours; if you could regulate to only 60 per cent, you would get less than two billion; so it is of extreme importance, from the power development standpoint at Muscle Shoals, to be able to vary the discharge during the 24 hours in order to make the amount available during any 24 hours fit the load factor of that period.

I presume this can be done without any difficulty at all in times of high water. The question is whether, at the low stages, when a regular discharge needs to be maintained for navigation, the water will not have to run by continuously. If it does, that will reduce somewhat the amount of power that can be gotten out of the streams at times of low water, with load factors less than 100 per cent.

There are three methods by which you can correct a situation such as you find in the Tennessee River of a variable river discharge. Two are by means of storage and one by means of stand-by steam. The two storage methods are storage on the river itself and storage elsewhere. If you store the waters on the Tennessee itself, you will raise the low water flow, increase the power, and reduce the amount of installation that you have to have to produce a certain amount of power. If you put storage on another stream, such as is proposed on the Tallapoosa, for example, you will get the same result in kilowatt hours, but you will have to have more kilowatts of installation to do it.

Senator HEFLIN. You mean you will have to build more dams?

Mr. MERRILL. You will have to use more dams and you will have to put in more generating capacity, because you will have to use the power plant located at the storage dam as a peak load plant, running it with water from storage, while the water is low on the Tennessee. Because you would be running both plants, the Tennessee River plant and the Tallapoosa plant, on a variable seasonal load factor, such an

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arrangement would mean a much greater installation than if both the storage and the power plants were located on the Tennessee River itself.

The CHAIRMAN. When you speak of the Tennessee, you mean——

Mr. MERRILL. The Tennessee and it tributaries.

The CHAIRMAN. The Tennessee and its tributaries, but not the Tallapoosa?

Mr. MERRILL. That is in another watershed altogether. Whether the one or the other plan should be followed is largely a question of dollars and cents. From an operating standpoint, there is no material difference. In one case, you will control the water and develop the energy at one point, and in the other case you will control the water at two points and switch the energy back and forth over a transmission line. It is purely an economic question. The third method is to put in steam installation. That method is now generally employed. Nearly all hydroelectric operations are dependent to a certain degree upon auxiliary steam. The only one that I know of, of any magnitude, that does not require steam auxiliaries is Niagara.

Senator MCKINLEY. Well, the minute you do that, though, Mr. Merrill, you are increasing your cost very considerably?

Mr. MERRILL. You are increasing your capital investment.

Senator MCKINLEY. Well, your interest charge, of course, but you are increasing the cost of your power very considerably?

Mr. MERRILL. Yes. It is again a question of dollars and cents as to the cheapest method of getting the number of kilowatt hours you want.

I have a chart here, Mr. Chairman, which shows for the two dams under consideration the amount of power available for certain percentages of the time. The percentages are shown at the top and the quantities here [indicating on chart]. The 12-month average power that you will get out of the river for any given maximum is also shown, but for hydraulic alone and for hydraulic and steam combined. I will be glad to put these into the record if they will be of any value to you.

The CHAIRMAN. All right; we will be glad to have them.

(The charts referred to by Mr. Merrill are on file with the clerk to the committee.)

Mr. MERRILL. I have also three tables here, the first of which shows for periods from 12 months to 6 months the amount of power available by the combination of steam and hydro. The second shows the amounts available from hydro only over the same intervals, giving Dams Nos. 2 and 3 separately. The third shows the same data for varying quantities at 100,000 horsepower intervals, and in percentages of time. I believe there is no difference between these figures and the ones that Colonel Barden introduced, other than would naturally come from the use of different efficiency factors and from the use of a somewhat different period of record.

The CHAIRMAN. Colonel Barden's testimony, as I remember it, showed that at Dam No. 2 the primary horsepower was 87,300.

Mr. MERRILL. Yes.

The CHAIRMAN. Now, that primary power was available 99½ per cent of the time.

Mr. MERRILL. Yes. What we have taken here is shown as the absolute minimum of the amount that is available in the actual lowest day.

The CHAIRMAN. Yes.

Power available at Muscle Shoals, with 95-foot [1] head at Dam No. 2, 40-foot [1] head at Dam No. 3, and a steam installation of 130,000 horsepower.

TABLE NO. I.

Maximum horsepower available hydro and steam combined for certain periods and percentages.			Horsepower-years per year available for such maxima.			Increase in horsepower-years for several steps.
Period.	Per cent of time.	Horsepower.	Horsepower years.	Per cent hydro.	Per cent steam.	
12 months	100	236,000	236,000	97	3	
11 months	92	310,000	308,000	93	7	72,000
10 months	83	363,000	355,000	90	10	47,000
9 months	75	420,000	401,000	89	11	46,000
8 months	67	487,000	447,000	88	12	46,000
7 months	58	558,000	492,000	87	13	45,000
6 months	50	658,600	542,000	87	13	50,000

[1] These are maximum heads. For variation in head, reference is made to Army Engineers Report, House Document No. 1262, Sixty-fourth Congress, first session.

NOTE.—In Tables I, II, and III all figures, except for 100 per cent of time, are based on average monthly discharges of Tennessee River at Florence, Ala., and all on basis of 90 per cent efficiency to switchboard, and, since adequate pondage is available, upon 100 per cent load factor.

Power available at Muscle Shoals, with 95-foot head at Dam No. 2, 40-foot head at Dam No. 3, and a steam installation of 130,000 horsepower—Continued.

TABLE NO. II.

Maximum hydro-horsepower available for certain periods and percentages of time.					Horsepower-years per year available for such maxima.			Increase in horsepower-years for several steps.
Period.	Per cent of time.	Maximum horsepower.			Both dams.	Dam No. 2.	Dam No. 3.	
		Both dams.	Dam No. 2.	Dam No. 3.				
12 months	100	105,000	74,500	31,400	103,000	74,600	31,400	72,000
11 months	92	180,000	123,300	53,700	178,000	125,200	52,800	47,000
10 months	83	233,000	163,500	69,500	225,000	158,000	67,000	45,000
9 months	75	288,000	202,000	86,000	270,000	190,000	80,000	47,000
8 months	67	357,000	250,000	107,000	317,000	223,000	94,000	48,000
7 months	58	428,000	299,000	129,000	365,000	255,000	110,000	49,000
6 months	50	528,000	368,000	160,000	414,000	289,000	125,000	

TABLE NO. III.

Per cent of time for which certain maxima of hydro-horsepower are available.				Horsepower-years per year available for such maxima.			Increase in horsepower-years for several steps.
Per cent of time.	Maximum horsepower.			Both dams.	Dam No. 2.	Dam No. 3.	
	Both dams.	Dam No. 2.	Dam No. 3.				
100	105,000	74,600	31,400	103,000	74,600	31,400	90,000
89	200,000	141,000	59,000	193,000	138,000	58,000	82,000
74	300,000	210,400	89,600	278,000	195,000	83,000	67,000
62	400,000	281,000	119,000	345,000	242,000	103,000	54,000
52	500,000	350,000	150,000	401,000	281,000	120,000	47,000
46	600,000	420,000	180,000	448,000	313,000	135,000	42,000
39	700,000	494,000	205,000	490,000	343,000	147,000	

Mr. MERRILL. It is only a mere figure; that is all. It would not serve as the limit of any power development. There are only a few days in the 26 years of record when the water approaches that minimum point.

I believe that is all I care to say on that particular point, Mr. Chairman, unless you have some questions.

Mr. CHAIRMAN. I was going to ask you about your load factor. You have taken that at 60 per cent?

Mr. MERRILL. Yes, sir.

The CHAIRMAN. That is the accepted formula, is it?

Mr. MERRILL. It depends, of course, upon the circumstances. I believe Colonel Keller, in his investigations in the South, found a load a load factor of around 55 per cent. It varies considerably throughout the country.

The CHAIRMAN. That depends upon the use that you are putting it to.

Mr. MERRILL. It does; entirely so.

The CHAIRMAN. If it should be found, for instance, in operating nitrate plant No. 2 that it could be operated by secondary power, and the plant stand idle for two months in the year, I think some of the witnesses have shown that there would be enough secondary power to operate the plant for 10 months in the year, and they would use that power which, to a great extent, would otherwise be unused.

Mr. MERRILL. Except as supplemented by steam.

The CHAIRMAN. Yes.

Mr. MERRILL. And, of course, that nitrate plant can take the secondary power when available and have the deficiencies made up with steam. It is an advantage, of course, whenever conditions will permit, to have the demand for power correspond to the run of the river.

The CHAIRMAN. Now, Mr. Merrill, I wish you would give us, if you have studied this phase of it, your judgment as to the value of that power, if you were going to sell it?

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Mr. MERRILL. You mean of the power available there at Muscle Shoals?

The CHAIRMAN. Yes.

Mr. MERRILL. Let me add this further statement, first, if I may:

The Alabama Power Co. proposes to turn over for the use of the nitrate plants the second hundred thousand horsepower available at Muscle Shoals, at Dam No. 2. Our figures show that you can get the full 100,000 horsepower during that 26 years of record, 77 per cent of the time, and that the average annual amount of energy that you will be able to get for the whole time is 82,000 horsepower years. That is, 82 per cent of the 100,000 is available during that period of 26 years. This is, as I recall, the same figure that was stated by the engineers of the Alabama Power Co.

If you will look at the first chart you will see that it is made up for both dams. The line on here for 140,000 horsepower means 100,000 horsepower at Dam No. 2, and 40,000 horsepower at Dam No. 3. That line is broken only once in the whole 26 years of record, and that was in 1904. This means that once and only once in the 26 years of record has the average monthly power available at Dam No. 2 fallen below 100,000 horsepower.

The CHAIRMAN. Let us see about that. Where do you get the years there?

Mr. MERRILL. The years are shown at the bottom of each section of the chart.

The CHAIRMAN. Yes.

Mr. MERRILL. That deep gap in 1904, shown in the dark green across the 140,000-horsepower line, means that for a two months period there, from the records we have, there would have been less than 100,000 horsepower available at Dam No. 2, so that there would have been no part of the second 100,000 available for that period.

I should explain that this chart is made up on the monthly averages. It does not show daily fluctuations, but it does show the averages per month; so that on the average for two months in 1904, if the water records for that year are correct, there would have been no water power available for the nitrate operations if they were dependent upon the second hundred thousand.

The CHAIRMAN. Mr. Merrill, Mr. Ford's offer, wherein he gives the Government the second 100,000 horsepower——

Mr. MERRILL. You mean the Alabama Power Co.'s offer.

The CHAIRMAN. Yes, I mean the Alabama Power Co. I said Mr. Ford's offer. I meant the offer of the Alabama Power Co.

Mr. MERRILL. Yes.

The CHAIRMAN. That would mean that there would be about two months, on the average, that we would not have the complete 100,000?

Mr. MERRILL. That means that in that particular year for two months, two consecutive months, there was no power at all available, none of the second 100,000 available.

The CHAIRMAN. Yes.

Mr. MERRILL. In the 312 months of the 26 years there are 70 months when all of the second 100,000 horsepower is not available.

Senator NORBECK. That makes what percentage?

Mr. MERRILL. There are 70 months in the 26 years, as shown on the chart when all of the second hundred thousand horsepower is not available. Some portion of it will be except for two months in 1904.

The CHAIRMAN. In that 26 years there was only one year when it lacked as much as two months?

Mr. MERRILL. Except for that year there was not any month in which there was not some of the second hundred thousand available.

The CHAIRMAN. Yes.

Mr. MERRILL. In those two months there was none available, that is, on the basis of monthly averages. There may have been certain days in the two months when there would be some.

The CHAIRMAN. Yes.

Mr. MERRILL. And there may have been days in other adjacent months. We worked on the monthly average basis, and we found two months in 1904 when there would have been no power available for the nitrate operations.

Senator NORBECK. But there were 70 months in which it was?

Mr. MERRILL. Seventy months when all of the second 100,000 was not available.

Senator HEFLIN. In 26 years?

Mr. MERRILL. In 26 years.

Senator NORBECK. For 20 or 25 per cent of the time, then, you were short on power?

Mr. MERRILL. For 22½ per cent of the time you would not have had the full supply, but the average supply for the 26 years from the second 100,000 horsepower would have been 82,000 horsepower years.

Senator MCKINLEY. So their offer, then, is really only 82,000 horsepower instead of 100,000 horsepower.

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The CHAIRMAN. Yes; I think that is plain. Now, I wish you would take up the question that I asked you a while ago, as to what this is worth down there, what its value is.

Mr. MERRILL. An answer to that, of course, would be only an opinion.

The CHAIRMAN. Yes; I realize that.

Mr. MERRILL. And would depend in some degree upon the amount available. I understand that the Alabama Power Co. presented evidence to your body showing that at the present time it is selling a considerable amount of power in large blocks at from 6 to 6½ mills per kilowatt hour. That is delivered, of course. If you build transmission lines from Muscle Shoals out to the surrounding country to deliver power you will, of course, add to your investment cost. I would think it would be safe, at least, to count on 4 to 5 mills per kilowatt hour as the wholesale price for any power delivered at Muscle Shoals.

Senator MCKINLEY. That would be $24 a year—4 mills?

Mr. MERRILL. Four mills is just a little over that.

The CHAIRMAN. Will you compute that for us? How much would we get if we sold the power developed there?

Mr. MERRILL. With 850,000 horsepower in installation, with the 130,000 horsepower steam stand-by, and on the assumption—and I wish you to notice the assumption—that you can regulate the daily fluctuations in water at both dams by the pondage behind them, you get approximately 3,000,000,000 kilowatt-hours.

The CHAIRMAN. Per year?

Mr. MERRILL. Per year.

The CHAIRMAN. To get the money that we sold it for at 4 mills, it would be four times three billion per year, would it?

Mr. MERRILL. That would be the gross proceeds, but I probably ought to qualify that by saying that a considerable portion of that is secondary. You could not expect to get the full amount on secondary power.

The CHAIRMAN. That is what I was going to ask you.

Mr. MERRILL. Yes.

The CHAIRMAN. A part of it is secondary?

Mr. MERRILL. Yes.

The CHAIRMAN. Take the primary horsepower now. How much per year would we get for that?

Mr. MERRILL. I was thinking of primary horsepower when I spoke about the price. A little over half of that total would be primary power, with the steam and the balance would be secondary power, varying from 6 months to 12 months, of course.

The CHAIRMAN. Now, how much money would we get for the primary horsepower?

Mr. MERRILL. Suppose we say, just for the sake of seeing what it would come to, that we have 1,500,000,000 primary kilowatt-hours at 4 mills——

The CHAIRMAN. Yes.

Mr. MERRILL. And that we have one had a half billion secondary at an average, say, of 1½ mills.

The CHAIRMAN. Yes.

Mr. MERRILL. That is $8,250,000, is it not?

Major BURNS. That is correct.

The CHAIRMAN. How much?

Major BURNS. $8,250,000.

The CHAIRMAN. Eight and a quarter million dollars?

Major BURNS. Yes sir; $8,250,000 a year.

The CHAIRMAN. $8,250,000 a year; yes.

Mr. MERRILL. I think those are conservative figures.

The CHAIRMAN. Could you give us an estimate of what it would cost to operate it and keep it in good condition?

Mr. MERRILL. It would require a pretty long guess on that, too, of course.

The CHAIRMAN. Yes; I know that is only an estimate. We can not expect to get it accurately; but I am trying to reach, if I can, a computation as to the net yearly income that we could get out of the property if we were going to put it on the market and sell it.

Mr. MERRILL. I did have some figures along that line.

Senator HEFLIN. I believe you state, Mr. Merrill——

The CHAIRMAN. Let him finish that, Senator. He is going to figure that out for us.

Senator HEFLIN. Yes.

Mr. MERRILL. The first cost you will have is your interest cost. I can tell you approximately waht that will be.

Senator MCKINLEY. Well, that is a $60,000,000 investment, is it not?

Mr. MERRILL. It is likely to be more than that, Senator. It is approximately a $70,000,000 investment down there in the two dams, if we adopt the estimate of the Army engineers, of $25,000,000 to complete Dam No. 2.

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The CHAIRMAN. It would hardly be fair to take that as the cost of those, because they were constructed during the war.

Senator MCKINLEY. Oh, no; this is the new work, mostly.

Mr. MERRILL. A large part of this is new construction. There was $17,000,000 of old investment in there; I mean the existing investment in there.

The CHAIRMAN. Yes; about $17,000,000.

Mr. MERRILL. The estimate is $50,000,000 for the new construction, besides some $2,300,000 for flowage rights. The figure there is $69,092,000. That is the total cost, not including interest during construction.

The CHAIRMAN. Oh, no.

Mr. MERRILL. If we take $70,000,000 as round figures, the interest on that per annum at 4 per cent is $2,800,000.

Your next item will be operating expenses. Colonel Cooper, when he testified before the House committee, estimated $1 per horsepower of installation for operating expenses. If that is so, and it appears to be approximately correct from certain estimates I have made on another basis, that is $850,000 for operation. You have, in addition to that the reserve for depreciation. Now, the plant down there, and particularly the mechanical equipment, is going to wear out, and when it wears out it has to be replaced. There may be major repairs upon the dam, due to floods. That is a casualty that ought to be taken into consideration. I have assumed that there will be a 4 per cent depreciation and retirement charge on the mechanical equipment, taken as $20,000,000 ($17,000,000 for the 850,000 horsepower installation at $20 a horsepower, and $3,000,000 added for the gate-operating mechanism, and the big gates along the crest of the dam). On that basis, we would have $800,000 additional for depreciation charges on the mechanical equipment. There is left a balance, then, of $50,000,000, comprising the heavy construction, like the dam, the locks, the power house, and such as that, on which I have taken one-half of 1 per cent, which would mean $250,000 a year.

Senator NORBECK. That is, assuming that it will neither play out nor go out of style in 200 years, is it not?

Mr. MERRILL. It ought to stay there 200 years. Of course, if it is subject to accident, the estimate is incorrect.

Senator NORBECK. But the probability is that it will last 200 years without change?

Mr. MERRILL. Yes; on the average, without anything more than current maintenance. The total is $4,700,000.

Senator NORBECK. To operate it.

Mr. MERRILL. Interest, operating expense, and depreciation.

Senator HEFLIN. And you could sell the horsepower for how much?

Senator NORBECK. You have not anything for fuel in the steam operation there?

Mr. MERRILL. No; this is hydro alone.

The CHAIRMAN. He does not have the steam.

Senator MCKINLEY. You have that in your steam cost; you figured it?

The CHAIRMAN. No.

Mr. MERRILL. No; it is not in there yet.

The CHAIRMAN. No.

Senator MCKINLEY. You would have to add it?

The CHAIRMAN. Yes; but when you added it you, of course, would add that much more to your income, because you are making primary out of it.

Senator HEFLIN. Do not forget to answer my question as to how much you get for the horsepower produced at Dam No. 1 and Dam No. 2 and Dam No. 3?

The CHAIRMAN. There is not any produced at Dam No. 1, Senator. You do not want that question to stand.

Mr. MERRILL. I have some rough figures here, Mr. Chairman, on the cost of operating the steam plant, using Colonel Barden's primary data, and assuming that the plant is operating six months of the year, which would be about $2,500,000 operating expense, including interest and depreciation on the steam plant, which would be $7,200,000 total expense, as against $8,250,000 total revenue, or about $1,000,000 balance. These figures, of course, I have not taken from any close examination of operating expenses elsewhere, or any close examination of the exact situation at Muscle Shoals.

The CHAIRMAN. These figures include water and steam, both?

Mr. MERRILL. Water and steam, both.

The CHAIRMAN. And 4 per cent on the investment?

Mr. MERRILL. On the investment in both.

Senator HEFLIN. What did you say in response to my question? I was called to the phone for a moment, Mr. Chairman.

The CHAIRMAN. Ask your question again, Senator. You do not want it to stand as you put it before, because Dam No. 1 is not a power dam at all.

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Senator HEFLIN. That is for navigation purposes. Dams 2 and 3; those are the dams I had in mind.

Mr. MERRILL. Dams 2 and 3?

Senator HEFLIN. What do you think the Government can get for the power produced at those two dams, per annum?

Mr. MERRILL. I said that with an installation of 850,000 horsepower, and with the ability to use the water at the two dams for daily regulation, they should get approximately 3,000,000,000 kilowatt hours. Assuming one-half of that would be primary power, which could be sold for 4 mills per kilowatt hour, and one-half secondary at 1½ mills per kilowatt hour, the total receipts would be $8,250,000. We have made some rough estimates here of operating expense, interest, and depreciation on both the hydro and steam plant totaling $7,200,000, or approximately $1,000,000 less.

The CHAIRMAN. Now, let us get the figures as to the horsepower. The primary would be how many horsepower?

Mr. MERRILL. About 236,000 horsepower years, primary.

The CHAIRMAN. And the same secondary?

Mr. MERRILL. The secondary is a little less than that because the total is 460,000 horsepower years.

The CHAIRMAN. Yes.

Mr. MERRILL. It is 224,000 horsepower years secondary.

Senator MCKINLEY. Mr. Merrill, would you mind analyzing a little more in detail that $2,500,000 which you say it will cost to operate the steam plant? How many days or months of the year would you have to be burning coal to operate it? Have you figured that?

Mr. MERRILL. You would have to be burning some coal, according to this record, on the average nearly one-half of the time.

Senator MCKINLEY. That would be——

Mr. MERRILL. One hundred and forty-nine months out of the 26 years, or 47.7 per cent.

Senator MCKINLEY. That would be approximately one-half of the time?

Mr. MERRILL. Yes; approximately one-half of the time, but of course not all this time at full capacity. The proportion of steam power would be about one-eighth of the total.

Senator MCKINLEY. Yes.

Mr. MERRILL. I have certain figures here prepared on the assumption that the steam plant is operating six months in the year. I have used Colonel Barden's figures of $172,800 per month for fuel for a steam plant of 80,000 horsepower capacity. I have taken as 130,000 horsepower the combined steam capacity in the Gorgas plant, and at Nitrate No. 1 and No. 2. Increasing Colonel Barden's figures in like ratio means $281,000 per month for fuel at full operation. These figures that I have just given you include six months full operation of the steam plant, which is considerably more than is necessary. They, however, include interest on only $5,000,000.

Senator MCKINLEY. But there is $10,000,000 invested?

Mr. MERRILL. Approximately $10,000,000. The interest on $5,000,000 is taken at 6 per cent, so that will offset to some extent the probable overcharge for the fuel, and I have estimated $15,000 per month for labor for 12 months in the year, or $180,000 total.

The CHAIRMAN. Would you keep your organization running the whole year, but only use it for six months?

Mr. MERRILL. A part of the organization has to be there. The reason I use that is that Colonel Barden gives $15,000 per month for the 80,000 horsepower installation for a period of three months plus $30,000 for the remainder of the year, or $75,000 per annum. I have used $180,000 per annum for a 130,000 horsepower install tion operating six months of the year. The figures, of course, are only rough approximations.

The CHAIRMAN. In these figures that you have given us, do you include the Gorgas?

Mr. MERRILL. The Gorgas is in there; yes.

The CHAIRMAN. It is in there?

Mr. MERRILL. Yes.

The CHAIRMAN. If we omit the Gorgas plant——

Mr. MERRILL. You will reduce the 130,000 by about 40,000 horsepower.

The CHAIRMAN. I do not know that that makes much difference. If we omit the Gorgas, that means that we would reduce the invested capital so much also?

Mr. MERRILL. Yes, sir; and if the steam is desirable, the additional unit of 30,000 kilowatts (40,000 horsepower) that was originally proposed for No. 2 should be put in. I understand the boilers are already there.

The CHAIRMAN. Yes; that should be increased.

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Mr. MERRILL. Of course, you understand, Mr. Chairman, that I have not attempted to get down to any figures that I can be certain of. They are merely illustrative figures, approximate figures of what you might expect. It happens that these figures were worked out roughly in connection with a study of Mr. Ford's offer, and the $5,000,000 that I have used for the steam plants is the $5,000,000 which he proposed to pay, and not an assumption of the actual value of the plant.

Mr. Chairman, you have asked several times, I have noticed in the record, about the sale of power at Niagara. Did you get that information?

The CHAIRMAN. About what?

Mr. MERRILL. The sale of power at Niagara. Have you got the information you wished?

The CHAIRMAN. No, sir; I have not. Can you give us any information on that?

Mr. MERRILL. I can give you some information about it.

The CHAIRMAN. I wish you would.

Mr. MERRILL. Power in the city of Buffalo is distributed by the Buffalo General Electric Co. That company has a steam plant in the city of Buffalo of 130,000 horsepower capacity, I believe. It has purchased for a number of years under contract from the Niagara Falls Power Co. 37,500 horsepower per annum. That is what is known as firm power. It is supposed to be 100 per cent load factor power. Their output of the Buffalo General Electric Co. in the year 1921 was 470,000,000 kilowatt hours. That is equivalent to 72,000 horsepower years, which means that of the amount of power they have to distribute two-thirds is steam and one-third is hydro. The Niagara Falls Power Co. sells the hydro power to the Buffalo General Electric Co. at $16 per horsepower per annum.

The CHAIRMAN. That would be how much per kilowatt hour?

Mr. MERRILL. 2½ mills per kilowatt hour if the load factor is 100 per cent.

The CHAIRMAN. Yes.

Mr. MERRILL. The maximum rate in the city of Buffalo for domestic service is 8 cents per kilowatt hour, with one cent per kilowatt hour discount for prompt payment. That means 7 cents per kilowatt hour.

Senator MCKINLEY. You had better explain, perhaps, that to make that 100 per cent load factor, that they paid 2½ mills for, it probably costs them 5 mills to——

Mr. MERRILL. No; I think the Buffalo General Electric Co. takes it on 100 per cent load factor itself. It would naturally do so, because it has no hydro of its own. It would take it 24 hours in the day, just as it comes, and supply the balance of its requirements from its steam plant.

Senator MCKINLEY. You mean by that that instead of having 37,000 demand it perhaps has a 50,000 or 60,000 demand?

Mr. MERRILL. They no doubt have a greater minimum demand than the 37,500 horsepower of hydro which they purchase.

Senator MCKINLEY. Yes.

Mr. MERRILL. Than this firm power, so called.

The CHAIRMAN. What does their steam cost them?

Mr. MERRILL. I can not tell you what it costs there. I have certain figures here of steam power costs.

The CHAIRMAN. Have you got the figures for the city of Cleveland?

Mr. MERRILL. I do not believe so. I can give you the figures on rates.

The CHAIRMAN. In Cleveland?

Mr. MERRILL. I think so.

The CHAIRMAN. The city of Cleveland is supplied by two companies, one owned by the city and one privately owned.

Senator MCKINLEY. That would not serve any purposes for the United States, because Cleveland has every advantage on water and coal.

The CHAIRMAN. Yes; but it is all generated with coal. There is no water power.

Senator MCKINLEY. But they can generate cheaper than almost anybody else.

The CHAIRMAN. Yes; they get very cheap coal, but I should say their coal would not be as cheap as at Gorgas, where there is no transportation at all.

Senator MCKINLEY. Oh, no.

The CHAIRMAN. Where it is taken right out of the mine?

Senator HEFLIN. Yes; Gorgas is right in the heart of the coal region in that section.

The CHAIRMAN. Yes; no steam power could compete with that.

Mr. MERRILL. This says that the Cleveland Electric Illuminating Co. has a straight line meter rate of 5 cents per kilowatt hour.

Senator MCKINLEY. That is 50 mills. That does not mean anything.

The CHAIRMAN. Well, can you give us the other rate in Cleveland—the rate of the municipal company?

Mr. MERRILL. I do not think that is given here. Presumably that is a pretty low rate.

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Senator McKINLEY. They are undoubtedly selling power at 11 or 12 mills instead of 50 mills.

The CHAIRMAN. The rate of this private company there, undoubtedly, in my judgment——

Senator McKINLEY. I say the Cleveland company is undoubtedly selling power at 11 or 12 mills.

Mr. MERRILL. The rate that I quoted is only for domestic household service.

Senator McKINLEY. That has nothing to do with your question, Mr. Chairman.

Mr. MERRILL. There are rates quoted in here down as low as 11 mills, I see.

The CHAIRMAN. Is there any uniformity, so that you could come anywhere near establishing the general rule as to the cost of distribution of electric power in cities?

Mr. MERRILL. I do not think so, Mr. Chairman. There is likely to be a wide variation, according to the character of construction, according to the volume of power handled, and to the management.

The CHAIRMAN. Well, take a large city. What I mean is, after the power is generated and brought to the city and then distributed from the central stations, as a rule, does it cost more to distribute it after the city gets it than it does to produce it and deliver it to the city?

Mr. MERRILL. Yes; I think it does cost consideralby more.

The CHAIRMAN. If you were so have delivered to an ordinary city at its distributing station, electricity for 2½ cents per kilowatt hour, say, it would cost more than 2½ cents to distribute it?

Mr. MERRILL. I think it would brobably cost more than twice that.

The CHAIRMAN. To distribute it?

Mr. MERRILL. Yes. You see, there is a huge investment in distribution systems in proportion to the amount of power carried over them. I believe it was Mr. Griffith of the Mortland Railway, Light & Power Co., who told me a few days ago that only 7 per cent of the power they generate in their system is sold for domestic use. It is a very small proportion. It carries a very heavy investment charge. It carries the lines; it carries the meters, and the office expenses in connection with the collection and billing are a hundred times greater than they are for power.

The CHAIRMAN. Yes.

Mr. MERRILL. And all of these items together make the cost of distribution after the power is received in the station in the city much greater than its generation and delivery to that point.

Senator McKINLEY. Mr. Chairman, right in that connection, in most places, except these very large cities, they use what is called alternating current, and that is transformed in transformers. If it is a large transformer it is out on the street, on the pole that you see, and then it is taken off by a dozen small customers from there.

The CHAIRMAN. Yes.

Senator McKINLEY. In the evening, when they are all using it once, in a large amount, the transforming loss is small, maybe 30 per cent, but at other times, when just a few people are using it off of that transformer, the loss might be 50 or 60 per cent. Those things——

The CHAIRMAN. They are all a part of the distribution system.

Senator McKINLEY. Yes; they all make up a part of the cost of the power.

The CHAIRMAN. After all, it seems to me that the whole thing is to wait for some ingenious Yankee to invent practical storage power.

Mr. MERRILL. That would make a very great difference.

The CHAIRMAN. So that you can take your electricity and put it in your basement, like you do your coal now.

Mr. MERRILL. In the State of California there is very close regulation of great public utilities and the rate regulation is on the basis of the cost of service per classes of service. The rate, as I recall it, for domestic service in San Francisco is 7 cents per kilowatt-hour. That is furnished by the Pacific Gas & Electric Co. Their average receipts, as I recall, are under 1 cent per kilowatt-hour.

The CHAIRMAN. What is the total amount?

Mr. MERRILL. Of the total amount sold for all purposes, and they are selling power in blocks for street railway corporations at under 6 mills, I think. That power used for railroad corporations in the city of San Francisco comes into the same substation as the power that is distributed for domestic use, but the rate for one is more than 10 times as great as for the other.

The CHAIRMAN. Yes.

Mr. MERRILL. And that is the rate fixed by public authority on the basis of the cost of service by classes of service.

The CHAIRMAN. You are not a chemist, Mr. Merrill, are you?

Mr. MERRILL. No, sir; I am not a chemist, Mr. Chairman.

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The CHAIRMAN. You can not give us any information with regard to these nitrate plants?

Mr. MERRILL. It would be of no value, because I would only be repeating what I have heard somebody else say.

The CHAIRMAN. Do you think of anything else, Mr. Merrill?

Senator HEFLIN. You have not expressed any opinion about the bids?

Mr. MERRILL. No; I want to speak a little, if you are through with this angle, on the financial relation of these bids.

The CHAIRMAN. All right, we would be very glad to hear you on that.

Mr. MERRILL. Let me put it in this way: Mr. Ford will pay $5,000,000 in cash for steam stations that are probably worth eight or nine million, for 130,000 horsepower of steam at three steam stations. In addition, the United States is to give him, for nothing, two nitrate plants, the Waco quarry, and the railroad, and a million or two dollars of construction equipment and supplies. There is $17,000,000, approximately, invested in Dam No. 2 at the present time by the Government.

It is proposed that the United States develop, and develop at once, Dam No. 2 and Dam No. 3, or develop them in series, one immediately after the other, at an amount estimated by the Army engineers at $25,000,000 for each dam.

It is proposed that the United States shall itself pay the cost of the flowage rights at Dam No. 3, which I believe the Army engineers estimate at about $2,300,000. That is his proposal, which, as far as I know, has not been changed.

It is proposed that the United States assume the liability for any damage suits that might be instituted by the Alabama Power Co. or the Air Nitrates Corporation on account of turning over property on which they claim an option.

The CHAIRMAN. I think, as far as the Alabama Power Co. is concerned, that has been modified, Mr. Merrill, in that he only gets the Government's interest in it.

Mr. MERRILL. He will himself assume liability there?

The CHAIRMAN. Yes.

Mr. MERRILL. Now, I have on that basis, made some computations of what the financial situation would be.

I was interested to find out for my own information at first just what liabilities Henry Ford will assume from a financial standpoint under his offer, and what liabilities the United States would be required to assume, and I have worked out here quite an extended computation of the interest and the amortization charges on these various properties under the various terms of the offer.

In making these computations I have taken the investment as already made to date as $16,250,000 as reported by the Secretary of War on February 1, 1922; and have assumed that the remaining liabilities which are unsatisfied at that date, would be paid during the ensuing year. I have assumed certain dates for the completion of the plant—those dates being the ones at which the Chief of Engineers states the properties can be completed, and also that Dam No. 3 is started and completed immediately after Dam No. 2. I have taken the interest during construction at 4½ per cent; for the United States is paying that much now, or approximately that much, on its Liberty bonds. I have assumed, however, that after the plants are completed, which will be in 1925, for Dam No. 2, and in 1928 for Dam No. 3, that the interest which the United States pays will be 4 per cent. I have made these estimates on two different general assumptions. One assumption is that interest during construction is not added as part of the investment cost, and the second, that it is.

Now, under the first general assumption, the interest which the United States would receive from Henry Ford under his offer for Dam No. 2 would be $95,200,000 in the hundred years. At Dam No. 3 it would be $97,480,000, or a total of $192,680,000.

The United States, on the assumptions that I have made, of 4½ per cent interest during construction and 4 per cent thereafter, would itself pay out during that same period from the United States Treasury, $282,810,000 or $90,130,000, more than Henry Ford pays in.

There is a proposal in the offer of Mr. Ford of an amortization charge of approximately $23,000 semiannually, made on the supposition that if he pays those amounts semiannually he will have, at the date of the termination of his lease period, amortized the entire cost of these properties.

I think this can be said of the amortization proposal: It is good, but only good if the United States goes into the money-loaning business, because the fund can accumulate its interest only if the United States takes these payments every six months as they come, and finds somebody who will bank them—either a bank or a trust company, or an insurance company—and pay 4 per cent interest compounded semiannually for 100 years and then turn it back, principal and interest. If they do that the amount, at the end of 100 years, will be $48,000,000, or close to that. The balance of some $10,000,000 to $20,000,000 of the cost will remain unamortized. As a matter

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of fact, the total amount paid in during the 100 years under the Ford proposal for the purpose of amortization on both dams will be only $4,415,000, and the effect is in no sense different than if he paid that much rental charge for the property, or paid an interest charge that included that amount, or increased his operation payments by that amount.

If the United States is going into the money-loaning business it had better go into, it on a scale worth while, and instead of limiting its operations to the $23,000 payment, take the entire payment, of some $2,000,000 per annum, loan it out at 4 per cent compounded semiannually, and accumulate, as it would, some $2,000,000,000 in the 100 years instead of a mere $48,000,000. One proposition is just as reasonable as the other. If Mr. Ford established an amortization fund himself, paid into such fund the $23,000 semiannually, assumed himself the responsibility for the semiannual interest payments upon the amounts in the fund, and at the end of the lease period turned over the fund with its interest accretions to the Government, amortization—to the extent of $48,000,000—would be a fact and not a mere camouflage. Under his proposal Mr. Ford does not amortize the properties, or any part of them. He merely pays the Government $4,415,000 during the lease period in semiannual amounts of approximately $23,000, which is as useful, and no more so, for amortizing the Government's investment, as any other revenues from taxes or otherwise, paid into the United States Treasury.

The CHAIRMAN. Did you give the amount that we would actually take in under the amortization proposition?

Mr. MERRILL. $4,415,000.

Senator HEFLIN. Four million?

Mr. MERRILL. $4,415,000 in 100 years from both plants.

Senator HEFLIN. The Government would pay $280,000,000?

Mr. MERRILL. Yes. $282,810,000 for interest alone.

Senator KENDRICK. And Mr. Ford would pay in approximately $180,000,000?

Mr. MERRILL. $192,680,000, or $90,130,000 less.

Senator MCKINLEY. Then the Government would be out $90,000,000 on the Ford proposition?

Mr. MERRILL. On interest alone, in 100 years, or $900,000 per annum.

Now, if the United States really wishes to amortize these properties on this four per cent sinking fund basis, compounded semi-annually, and get rid of the entire investment, it will not only have to go into the money loaning business (or else pay the interest itself), but it will also have to put in itself semiannually an amount in addition to the sum which Mr. Ford proposes to pay. That is, if the Government actually intends to amortize the entire investment in the hydro plants, over the period of a hundred years, it will have to have a total of $6,200,000 or about $1,800,000 more than Mr. Ford proposes to pay, because Mr. Ford does not propose to amortize the entire investment in the property.

Therefore, on the assumption that interest during construction is not a part of the investment, the excess of items which the United States would be required to pay for interest and amortization, over what it received under the Ford offer, is $92,000,000. If we proceed on the assumption that the amount of interest charges during construction is properly a part of the construction cost, as is done in every private undertaking, the deficiency then in the payments of Mr. Ford to make up what the United States would have to pay out of its own Treasury, is $116,000,000 in the 100 years. That, you will understand, is on the basis that the United States pays 4½ per cent interest on borrowed money from the time the plants are started until the plants are finished, and that it pays 4 per cent thereafter during the lease period. I have the figures also on the assumption that it can borrow money for 3 per cent interest instead of 4. If we assume 3 per cent, the liabilities of the United States in excess of its receipts under the Ford offer would still be: If interest during construction is not included in cost, $23,180,000 in the 100 years, and if interest during construction is charged into cost, $39,423,000.

Senator HEFLIN. Your position is that Mr. Ford will not pay to the Government all together, from the time he takes charge of this to the expiration of the 100 years, over four million and some odd dollars in interest.

Mr. MERRILL. No; that is amortization only. Four million four hundred and fifteen thousand dollars for amortization. He will pay $192,000,000 in interest.

Senator HEFLIN. How much will he have paid in in all at the end of a hundred years?

Mr. MERRILL. $197,000,000.

Senator HEFLIN. That is nearly double the investment that the Government will make there?

Mr. MERRILL. It is nearly double the investment the Government would make, but the Government in the meantime will itself be required to pay out $289,000,000

in interest and amortization charges if interest during construction is not charged into cost, and $313,000,000 if it is. That is, the difference between what the Government pays out and what it takes in during the hundred years for both interest and amortization, under Ford's proposal, and assuming the Government can borrow at 4 per cent, is from $92,000,000 to $116,000,000.

There is one other way of approaching this question from the financial standpoint and that is to find out what is the present worth of the payments Mr. Ford will make from time to time during the life of his proposal and the present worth of the payments which the United States would be required to make from time to time for interest and other purposes.

I have computed the present worth on the basis of 4 per cent compound interest as of the date of July 1, 1922, and the result is that the payments made by the United States under the Ford proposal throughout the life of the lease would be worth, as of July 1, 1922, $28,000,000 more than the payments made by Mr. Ford, this on the assumption that interest during construction is not charged in as a part of the capital. If interest is charged on construction as a part of capital, the amount is a few thousand dollars less than $28,000,000.

The CHAIRMAN. You have always given two comparisons, one on the assumption that the interest is to be paid on construction charged from the time they are paid until it is completed and another one is that no interest is to be charged. Personally I do not understand why anybody would make a computation and figure no interest on these charges. Why isn't it just as legitimate for us now to pay interest on $70,000,000 on the construction of Dam No. 2 as it is to wait until it is completed and pay the interest then?

Mr. MERRILL. The difference between the two methods is this: If interest is paid during construction, the question is whether it shall be considered as a cost of operation or a charge to capital. We have an investment of, say, $70,000,000. The interest during the construction period is $8,000,000. Now, shall we call the investment on which you are to pay interest thereafter $78,000,000 or $70,000,000? If you call it $70,000,000, then you compute the interest thereafter on the $70,000,000 and add the $8,000,000 into your operating expenses. If you call it $78,000,000, you have considered the $8,000,000 as a part of the original cost, have added it to your capital, and thereafter pay interest upon it.

The CHAIRMAN. If the Government or a private party started to build a dam and was going to take five years to build it at a cost of $20,000,000, and they spent $4,000,000 a year on it, they would have to get the money and would have to pay interest on it all the time, as fast as it was used?

Mr. MERRILL. Yes.

The CHAIRMAN. And if they had the money and did not have to borrow it, they would be entitled to interest on it at whatever rate it would bear, if they loaned it to somebody. That would be the way to look at it so far as private parties are concerned.

Mr. MERRILL. And they add that interest during construction in as capital expenditure and not as operating expense.

The CHAIRMAN. Yes, why isn't that right?

Mr. MERRILL. It is right from a business standpoint, but a great many people, as you know, not only fail to add interest during construction into cost, when they are considering Government operation, but even ignore interest as a cost of operation. I suspect that many of the arguments which have been presented to you concerning Muscle Shoals have failed to include at any stage the interest obligations of the Government. It is no less a proper charge under Government than under private operation.

The CHAIRMAN. I should think so. In other words, if you and I were going to do anything of that kind that is what we would have to do whether we wanted to or not, and it would not be an answer to it, it seems to me, to say that you have this money already and don't have to borrow it, because we could loan it and get interest on it.

Mr. MERRILL. These last figures that I have given you, Mr. Chairman, mean this: If the United States had $28,000,000 available on July 1, 1922, to put out at interest at 4 per cent per annum, that amount plus the interest received would be just enough to liquidate its recurrent liabilities in excess of its receipts from Mr. Ford. On the basis of present worth as of July 1, 1922, $28,000,000 is the deficiency in Mr. Ford's proposal. If you figure it on the actual deficiency in dollars over the 100 years, it is from $92,000,000 to $116,000,000, as stated before.

There is one other method of approach to the question, and that is to determine values as of some future date. Testimony along such line was presented to the House committee. I would not take the time to discuss this basis of comparison had it not been presented before, and did it not, therefore, seem desirable to show its relation to the other bases of comparison which we have just been discussing. If we compute the "present worth" as of the date of expiration of the leases (assumed on July 1,

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2025), of the several payments for interest and amortization, and the corresponding current liabilities of the United States for these same items, we will get the total to which the several annual and semiannual payments would amount if put at compound interest from the time when paid, or accrued, until the termination of the lease period. We would find by this process, with interest at 4 per cent, that the value as of July 1, 2025, of the liabilities of the United States under the Ford offer in excess of payments by Mr. Ford is somewhat more than $1,700,000,000. This is the meaning of the figure. If that portion of the accruing charges for interest and amortization on the two hydro plants, which, under the Ford offer, would be paid by the United States instead of by Mr. Ford, were, instead of being so paid, put at 4 per cent compound interest and allowed to accumulate until July 1, 2025, the assumed end of the lease period, they would amount to $1,700,000,000. Since, however, we have dealt with the same quantities in computing the present worth as of July 1, 1922, the value of $1,700,000,000 on July 1, 2025, is the same as of $28,000,000 payable on July 1, 1922; for the latter sum if put at compound interest at 4 per cent will be equal to the former on the former date. Whichever date and amount, therefore, is used, means simply this: The liabilities which the United States would assume under the Ford offer, in excess of the payments made by Mr. Ford, would for the two power plants alone be equivalent to a cash gift upon execution of the lease of $28,000,000. This is in addition to the proposal that the steam plants be sold to him at about one-half their value, and that the two nitrate plants, with their accessories, costing something over $70,000,000, be given to him outright. I have here the detailed computations if you care to have them.

The CHAIRMAN. Yes. I would like to have you give that to the reporter.

Mr. MERRILL. And I would like to have it go in as an appendix to the record. Preceding the detailed computations is a table summarizing the results under the various assumptions.

Senator HEFLIN. Mr. Merrill, Mr. Ford's chief engineer, Mr. Mayo, claims that he will produce fertilizer at Muscle Shoals, if he can get control of this cheap horsepower, at half the price the farmer now pays for it. The fertilizer bill, I believe, for the United States now, annually, is something over $300,000,000. Mr. Theodore Swann, of Alabama, testified yesterday before the committee that he thought fertilizer could be produced at one-fourth of what it costs now. What is your idea about that, or do you know anything about that?

Mr. MERRILL. I do not know. What is the testimony you get from people who really know something about the manufacture of fertilizer?

Senator HEFLIN. Mr. Swann is a manufacturer himself.

The CHAIRMAN. I do not think he testified to that yesterday, that it could be manufacturered at one-fourth the cost at the plant there.

Senator HEFLIN. Yes; I think he did.

The CHAIRMAN. I think he really stated that at plant No. 2 it was very doubtful whether you could make fertilizer at a price that would compete with the present prices of the market.

Senator HEFLIN. What is your recollection of his testimony, Major Burns?

Major BURNS. I think you are mistaken in that, Senator. I do not believe he made the statement that he could make fertilizer at one-fourth the cost, but he said he hoped that you might reduce the cost of fertilizer by the use of phosphoric acid; but he did not even come out flat-footedly and say that he could make ammonium phosphate at a less price than fertilizer is made at now.

Senator HEFLIN. My recollection is he said he could make it for one-fourth less.

Major BURNS. He said he could eliminate the use of sulphuric acid, which would have the effect of reducing the price of ammonia by one-fourth, that is quire correct; but he didn't say that even ammonium sulphate would be any cheaper than the present combination of ammonia and phosphoric acid.

Senator HEFLIN. That is my recollection of his testimony, and I asked the question because I had that in mind when I asked it.

Of course, we want to do, with these various water powers, the most good for the people. In leasing the water power at Muscle Shoals and the equipment at Muscle Shoals, we ought to have in mind the good that will be done for the people of the United States. As the thing stands to-day the farmers are absolutely at the mercy of the Fertilizer Trust; they have to pay whatever price the trust demands, and Mr. Ford proposes to make fertilizer at a price much cheaper than the price they now have to pay. I figure that if the fertilizer bill for the farmers of the United States is $300,000,000 a year, that if we could take off one-sixth from that present price, that would be $50,000,000 a year, and that amount, for a period of 100 years, would be a saving of $5,000,000,000 to the farmers of the United States. Don't you think that would be a rather beneficial thing?

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Mr. MERRILL. There is no doubt that it would be beneficial to reduce the cost of fertilizer. The question here is whether this proposal is the way to do it and whether in consideration of doing a good thing for a certain class of people Mr. Henry Ford should individually be subsidized to the degree that this proposal will subsidize him.

Senator HEFLIN. Do you think this power will be developed and utilized unless it is leased out to some private individual?

Mr. MERRILL. I personally think that the power can better be developed, either through construction by the Government of a plant and subsequent leasing of it, or by arrangements whereby private capital will furnish the money to construct it under a proper arrangement with the Government.

Senator HEFLIN. Now, the fertilizer people, the Fertilizer Trust and the power people, the various power concerns of the country, are fighting Mr. Ford's offer. They do not want him to get hold of Muscle Shoals. Don't you suppose that if Mr. Ford's offer is rejected and the Government goes ahead and develops the power there, and undertakes to untilize it, that these same people will say that the Government ought not to be in business in competition with them?

Mr. MERRILL. Perhaps so; they say that all the time.

Senator HEFLIN. And have they not many times prevented development by the Government because of that cry they have made and because of the power that they have been able to exercise in Congress?

Mr. MERRILL. Well, I personally agree with them that the Government should not be in business, unless it is forced into business.

Senator HEFLIN. Unless it is forced in?

Mr. MERRILL. Yes.

Senator HEFLIN. I do, too. I do not think the Government, as a rule, ought to go into business in competition with private enterprise; but here is an opportunity for the Government to lease this property down there, property which is now of no value to-day; the dam has not been completed, and navigation of the river is obstructed, and Mr. Ford offers to take it and offers to bind himself in a contract with the Government to produce fertilizers, and his engineer says that he thinks he has a secret process through which he can make fertilizer at half the cost the farmer is paying for it to-day.

Mr. MERRILL. If we are going to do that, assuming that it is a good thing to do that, why do it under such unconscionable terms?

Senator HEFLIN. He has made about the best offer, has he not?

Mr. MERRILL. I do not think so.

Senator HEFLIN. Whose offer is better than his?

Mr. MERRILL. I think from every practical standpoint that the offer of the Alabama Power Co. is more favorable to the United States than his. That matter I would like to discuss by itself. But we have this situation: It is proposed that the United States shall donate under this offer property for which it has paid over $70,000,000; that it shall loan its credit to a private individual for $50,000,000 at 4 per cent interest; that it shall give him the use of some $20,000,000 more property for nothing, and that in addition it shall assume in his behalf liabilities of a cash value of $28,000,000. In return for all this Mr. Ford promises, under his offer, that he will operate nitrate plant No. 2 up to its present capacity of 110,000 tons of ammonium nitrate per year—not in the production of fertilizers, but in the production of fertilizer compounds—and that is all he offers. Now, if he stops there—and I think in interpreting the contract you must assume that the parties to the contract will give no more than they offer to give under the written contract—you will, out of that 460,000 horsepower available at those two dams, have about 100,000 horsepower employed in the nitrate operations, and there will be left for Mr. Ford's use, his private use, 360,000 horsepower, of the cheapest power in the United States, not excepting Niagara—cheap to Mr. Ford for the simple reason that he pays only a part of the cost of that power and the rest of it is paid out of the United States Treasury.

Senator HEFLIN. As the matter now stands it is serving no purpose at all, you know.

Mr. MERRILL. That is quite right.

Senator HEFLIN. But if Mr. Ford takes it and Mr. Mayo's statement is correct, that he can make fertilizer for half the present cost, and if it should result in reducing the fertilizer cost to the farmers of the United States by half, and the supply should stay as it is now—although of course we know that it would be double and much more than double that in years to come—that would be a saving of about $15,000,000,000 to the farmers of the United States in a hundred years' time.

Mr. MERRILL. There are a good many "ifs" in there and I do not know what value to give to the "ifs." I am not familiar with the chemical end of the processes.

The CHAIRMAN. And the "ifs" mean that, there isn't any agreement wherever those "ifs" come in.

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Mr. MERRILL. Certainly not. It is only the obligation which Mr. Ford legally assumes that can be relied upon. He can be expected to carry out only the obligations which are written into the exact terms of the contract.

Senator HEFLIN. How much power do you think he will use in the manufacture of fertilizer?

Mr. MERRILL. He has guaranteed only to operate to the capacity of 110,000 tons of ammonium nitrate per annum, which takes 90,000 horsepower, approximately. I have used 100,000 in order to be perfectly safe.

Senator HEFLIN. That would leave him how much horsepower?

Mr. MERRILL. That will leave him 360,000 horsepower for his own uses.

Senator HEFLIN. At Dams 2 and 3?

Mr. MERRILL. At Dams 2 and 3, and steam plants, which would allow Mr. Ford——

Senator HEFLIN. Did you figure the Gorgas plant in there?

Mr. MERRILL. I figured the Gorgas plant in there.

Senator HEFLIN. Suppose the Gorgas plant had not been figured in that?

Mr. MERRILL. It will reduce it about 30,000 horsepower.

Senator HEFLIN. Reduce it about 30,000 horsepower?

Mr. MERRILL. Yes; or 40,000.

The CHAIRMAN. If you eliminate the Gorgas plant, then you must assume that Mr. Ford sells it to the Alabama Power Co.

Mr. MERRILL. Yes, sir.

The CHAIRMAN. And that he will get money for it?

Mr. MERRILL. Yes, sir; and put it in his own pocket.

The CHAIRMAN. Of course, so that it would reduce, by whatever he got for it, the $5,000,000 that he had to pay. I think it is conceded that he could get between two and three million dollars for it—for the Government's interest in the Gorgas plant—so in reality he would be paying only from two and a half to three million dollars, instead of five million.

Mr. MERRILL. Yes. We have so far been considering this offer strictly from the income and outgo standpoint, interest and amortization only. Now, let us consider it from another standpoint. There will be property down there with an investment value of approximately $70,000,000 in addition to the two nitrate plants. Under the Ford offer the company will take care of the maintenance of the power houses and power-house equipment at the two dams and make the necessary replacements. It will pay $55,000 per annum for the maintenance of the two dams, outside of the power-house section and the locks. I understand the Engineer Department thinks that $55,000 is probably sufficient to pay the sheer operating expense of the locks. It does not take into account, however, in my judgment, maintenance and repair charges. There are along that dam, or I believe there will be when completed, a long series of steel gates. Are there not?

Major BURNS. There are; yes.

Mr. MERRILL. And those are going to be not only expensive to operate but expensive to repair. They are subject to injury at time of flood, or at overflow time. There is always a possibility in overflow time, on a big river like the Tennessee River, that you will get a scouring under the toe of the dam which will involve millions of dollars of expense. None of that is assumed by Mr. Ford in his offer. The United States must assume complete responsibility. There is nothing said in that contract about who has the responsibility or what would happen should, by flood or otherwise, a part of the power plant be wrecked, and in the absence of any stipulation, I assume it would be the Government's obligation to replace it.

Then there are other items that need to be taken into account. Property like a power plant depreciates, through mere expiration of life, beyond the point that it is taken up by ordinary repairs and replacements. A property like that, after operating for a period of 30 years, will have probably not to exceed 70 per cent of original value as far as mechanical equipment is concerned. Mr. Ford proposes to replace items of equipment as they go out. There is nothing in his proposal for taking care of the depreciation in service value which will have accrued on that property at the end of a hundred years, and when it comes back to the Government it will be returned as a property materially less in value than its original cost unless the United States, during the hundred years, sets up its own depreciation reserves.

Mr. Ford asks for a lease period of a hundred years. That matter, as you all know, was thoroughly discussed prior to the passage of the Federal water power act. Under that act the term is limited to 50 years, subject to renewal under certain conditions at the end of the 50-year period. Now, if a man puts in every dollar of his own money and assumes all the risk himself he can get a lease for 50 years. The proposal here is that if the Government furnishes him every dollar on which he goes in, then he ought to have 100 years. I see no reason, no legitimate reason, for extending that lease period

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beyond the point of 50 years. Certainly the proposal put in here by Henry Ford is more favorable to him than anything that has ever been presented to the Federal Power Commission under the act, where the period is limited to 50 years; contains far more opportunities for making profit, because the power, three fourths of which at least will be available for Mr. Ford's private use, is subject to no regulation whatever by the Federal Government or by the State so long as he uses it in his own private operations, as it is his declared purpose to do. I believe, if the offer should be approved, that there is no manufacturing undertaking in which Mr. Ford would care to enter where power was any material factor in which any other concern in the United States could have a chance of competing with him.

In your discussions of this offer there has been no classification, nor any clear statement, of what is meant by the cost of production on which the 8 per cent profit is to be applied.

The CHAIRMAN. There has been a dispute about that several times. It is not clear in the contract.

Mr. MERRILL. Does it include interest on the property?

The CHAIRMAN. I do not know.

Mr. MERRILL. That is a very material matter, it seems to me.

The CHAIRMAN. Yes; I think it is very indefinite myself, Mr. Merrill.

Mr. MERRILL. If Mr. Ford is allowed to add interest on cost of construction of the property which he will own, when the Government gives it to him, that is on $83,000,000, it will make a very considerable difference as to whether fertilizer can or can not be produced at a profit, because the interest charges alone on $83,000,000 at 4 per cent would be $3,200,000 per annum; or, if taken at its written off value, say $25,000,000, there again would be $1,000,000 of interest charges per annum on property for which Mr. Henry Ford pays not one cent.

The CHAIRMAN. I think the representatives of Mr. Ford contend that this would be based on that part of the $5,000,000 that he paid for all the property which would be the proportion that the particular part used in the manufacture of fertilizer bore to the entire property. I believe that was the contention, was it not, Senator?

Senator HEFLIN. How is that, Mr. Chairman?

The CHAIRMAN. I think that was the contention of his representatives.

Mr. MERRILL. That, of course, would be a reasonable division of it, but it seems to me that this point is important, and if you are to consider the question of getting a cheap fertilizer to the farmers, that it must be cleared up.

The CHAIRMAN. As a lawyer, I would be very doubtful whether a court, in construing that part of the proportion would give it that construction, and certainly Mr. Ford, or the corporation which is organized, would not be bound by the opinion of the men who testified here.

Mr. MERRILL. Not at all.

The CHAIRMAN. It seems to me if I were a court and required to pass upon the proposition as to what would be the basis of that computation I would take the value of the property and he should be entitled, I should think, to the interest on the value of the property, no matter whether he got it for nothing or what it cost him.

Senator HEFLIN. You could not figure in the cost of fertilizer the cost of horsepower that he used for the manufacture of automobiles.

The CHAIRMAN. Oh, no; I do not contend that.

Senator HEFLIN. You could only figure the horsepower used in producing fertilizer.

The CHAIRMAN. That would only be the horsepower that he used in the production of that fertilizer——

Senator HEFLIN. And that could be separated from the other, I should think.

Mr. MERRILL. But the question is this: First, whether he could do it; second, if he could do it, whether he should be allowed in the cost of the fertilizer to the farmers of the United States interest on property for which he pays not one cent.

The CHAIRMAN. Under his bid he would be allowed to do that, in my judgment, and I believe that any lawyer who would analyze that would say that was correct.

Senator HEFLIN. But if he could do that and make good, as Mr. Ford has suggested here, produce fertilizer at half price, he would be doing a service to the farmers of the country, wouldn't he?

Mr. MERRILL. If.

The CHAIRMAN. Anybody who will produce fertilizer at half the present cost will be doing a great good to everybody. There isn't any doubt about that.

Mr. MERRILL. Have you any other questions in regard to this phase?

The CHAIRMAN. No; but I will ask you to take up the other items.

Senator HEFLIN. Then your commission doesn't look with favor on Mr. Ford's offer?

Mr. MERRILL. I can not say. I am speaking as an individual here.

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Senator HEFLIN. As an individual representing the commission, you do not look with favor on Mr. Ford's offer, do you?

Mr. MERRILL. I think Mr. Ford's offer gives more to him than there is any necessity for the United States giving in order to get that property operating down there. It seems to me that it is sheer, outright subsidy not only with respect to fertilizers, which might be justified, but that it is a sheer, outright subsidy to Mr. Henry Ford in his private operations.

Senator HEFLIN. Do you think any other party who bid here would take the property, use it in the manufacture of fertilizer, and sell fertilizer to the farmers at as advantageous a price as Mr. Ford would?

Mr. MERRILL. I would far prefer, if the judgment rested with me, to see the United States itself retain control of this property and operate it than to turn it over under the terms of any such proposal as his.

Senator HEFLIN. If it should operate them it would be in competition with private enterprise, wouldn't it?

Mr. MERRILL. Certainly.

Senator HEFLIN. I thought you said you were opposed to that?

Mr. MERRILL. I said I opposed it except under conditions where that seemed to be the only way out.

Senator HEFLIN. Would you favor the Government operating it and making fertilizer in time of peace and selling the fertilizer to the farmers?

Mr. MERRILL. I think it would be far preferable to this proposal here.

The CHAIRMAN. Of course, there is an excuse, in my judgment, for the Government operating this plant in time of peace or at any other time, because the Government has it, it had it as a war proposition, and it wants either to retain it or keep it in such shape that explosives can be made in time of war. There is more reason why it should operate a plant of that kind than there is for it to go out and engage in the development of some business where there wasn't any governmental function to be performed.

Senator HEFLIN. But would not all these forces that are now fighting the Ford offer, if the Government was to operate that plant in competition with them, fight that proposition? What they are fighting is competition. They don't care whether it comes from Henry Ford or the Government. Don't you think that is the situation?

Mr. MERRILL. I assume there is that feeling, yes, and there naturally would be. I think there is probably greater feeling of opposition against Henry Ford doing it than against the United States doing it, for the simple reason that the United States, if it charges the cost in, could not produce it as cheaply as Henry Ford, because he charges a part of the cost to himself and the rest to the United States, and the charge to the United States is all covered up.

Senator HEFLIN. And they would rather the Government would handle it or anybody else, than Henry Ford, because they believe Henry Ford will make good and that he will actually sell fertilizer cheaper and make them bring their price down, and that is the real cause of it.

Mr. MERRILL. There is no doubt that there might be that attitude on the part of the fertilizer people. I think, on the other hand, that Mr. Henry Ford himself is not going down there on a philanthropic enterprise to produce fertilizer for the United States, half as much as he is going to get the cheapest power in the United States for his own operations.

Senator HEFLIN. Well, wouldn't he be entitled to use it to his advantage if he would sell the product of his factory as reasonably as he sold his automobiles, when you compare the price of his automobile with the price of other automobiles?

Mr. MERRILL. That is all right, when he is spending his own money to do it.

Senator HEFLIN. He is offering to spend some of his money for a project now doing nothing, serving no good purpose, and Ford will make it useful to millions of our people if he gets it.

Mr. MERRILL. Mr. Chairman. I will just review briefly the differences in certain phrases of the Alabama Power Co. offer and the Ford offer. The Alabama Power Co.'s offer is to take a lease on the property there under the terms of the Federal water power act for a period of 50 years, and in so doing they will be subject to all the terms of the water power act. The properties will be subject to recapture at no increased cost at the end of the 50-year period. Their rates will be subject to regulation by either the Federal Power Commission or by the State of Alabama, or whatever State they operate in. Their construction will be subject to supervision by the United States and their operation will be subject to supervision by the United States. They will be required to pay all the charges, whatever they may be, for maintenance and operation of power houses and dams, with the sole exception of the locks; they will be required under the terms of the Federal water power act to set up adequate depreciation reserves covering the entire property.

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Now, from a financial standpoint, there is this difference. The nitrate properties remain in the possession of the United States, with the exception of the steam plant. The Alabama Power Co. offers $5,000,000 for the steam plants, which is the same price that Mr. Ford offers for the steam plants and all the rest of it. The steam plants are probably worth more than $5,000,000. In any event it is, in this respect, as much better than the Ford offer as the difference between the cost of the steam plants and the cost of all the property.

The Government has $17,000,000 invested in Dam No. 2, none in Dam No. 3, and the proposal is to build at this time only Dam No. 2.

Seventeen million dollars in Dam No. 2 is to be transferred to the Alabama Power Co., and they are themselves to raise the finances for the completion of the project, estimated by the Army engineers at $25,000,000. In return for the use of the $17,000,000 worth of property in the dam they will turn over, free of charge to the United States, or its designee, the second 100,000 primary horsepower, which we were discussing earlier, which means, in fact, about 82,000 horsepower years. The interest at 4 per cent per annum on $17,000,000 is $680,000 a year. In order for the 82,000 horsepower to offset the interest charges it would have to be computed as worth approximately $8 a horsepower. I can put the exact figure in the record later. No; I have it here; $8.30 per horsepower year, or 1¼ mills per kilowatt hour.

If the Alabama Power Co. offer is given serious consideration there is one thing that needs to be cleared up in it in relation to this 100,000 secondary horsepower, and that is the relation of the load factor; whether they mean that after 100,000 horsepower at Dam No. 2, at 100 per cent load factor, is available for their use that the next 100,000 horsepower is available for the United States, or whether that first 100,000 horsepower means 100,000 horsepower of continuous energy, which would be modified materially by the load factor at which it is operated.

The CHAIRMAN. That is a point that has not been raised before, and it strikes me as being a very important consideration. I had not thought of it, I confess, and nobody had called it to our attention.

Mr. MERRILL. We will suppose, for instance, that they are operating on a 50 per cent load factor; and that 10,000 second-feet at that dam would produce 100,000 horsepower when operating at 100 per cent load factor. In order, then, to get 100,000 horsepower, they have got to have 20,000 second-feet flowing; that is, in order, to get it all the time. Now, the question is whether their 100,000 ends with the first 10,000 second-feet or with such an amount more as it would be necessary for them to have in order to get 100,000 horsepower continuously.

The CHAIRMAN. Of course that would make a very material difference as to the real amount of power that the Government was going to get.

Mr. MERRILL. Unless there are possibilities there, during the low-water period, which is the critical period of so regulating the discharge of the river as to affect the daily fluctuations, when of course that question would disappear.

Now, the question might be raised, I presume, why the transfer of $17,000,000 worth of Government property to the Alabama Power Co. Why, if the offer in general is acceptable, should not the Government retain title to it and lease it? There is only this question there. You would have another Gorgas situation over again, only worse, because you would have in the same actual structure money invested by the Government and money invested by the power company, and it would be practically impossible for the power company, under such circumstances, to issue bonds or any other form of security against the investment there, because it would not own the property.

On the other hand the transfer of it for the lease period does not affect the interest of the United States at all, because at the end of the lease period, if the Government desires to acquire the properties, it can get them back at the price the company itself has put in; and it would not be required to pay a cent for its own $17,000,000 worth of property, notwithstanding the fact that it might pass fee-simple title for it. I think the only question involved there is the question of the ability to handle the financial operations under a mixed ownership.

Of course the major difference between the two proposals is this—or perhaps I should say the one of major interest—that the Alabama Power Co. does not propose to go into the production of fertilizers. It seems to me, however, although I claim no knowledge whatever in regard to fertilizer production, that if the United States, owning the property for the production of fertilizers, the nitrate plants, and having turned over to it, free of cost, 82,000 horsepower which it can charge up at nothing in its operations, can not either itself produce fertilizers, or find somebody to whom it can turn over the property to produce fertilizers, at a figure which will reduce the present cost, then we had better leave the fertilizer manufacturing question alone for the present. There need be no investment charge and no power charge in its operation.

The CHAIRMAN. There would be an investment charge, but no power charge.

Mr. MERRILL. The Government need not charge interest unless it wishes to. It is not charging any interest under the Ford offer. In fact, under that offer, in addition to the $1,000,000 per annum excess charges on account of its water-power plant, the Government will pay $3,200,000 annual interest on the property that it is giving to Mr. Ford for nothing, so that it will be in the hole $4,000,000 each year. It can hardly do worse by direct operation or by leasing the nitrate plants as an independent proposition.

The CHAIRMAN. The Alabama Power Co. offers to pay $5,000,000 for the steam plant?

Mr. MERRILL. The same $5,000,000 that Mr. Ford offers, or the same amount rather, only the Alabama Power Co. pays it for the steam plants alone.

The CHAIRMAN. And it gets title outright to the steam plants?

Mr. MERRILL. It gets title outright to the steam plants, in the same way in which Mr. Ford, for $5,000,000, will get title outright, not only to the steam plants but to the nitrate plants, transmission lines, railroads, and everything.

The CHAIRMAN. Yes; and that includes the houses, residences, etc.?

Mr. MERRILL. Yes.

The CHAIRMAN. And the Alabama Power Co. leases those. They are included with the dam, but not with the nitrate plants, as I understand it.

Mr. MERRILL. My recollection is that they take only such buildings as are necessary for operation of the steam plants and hydro plants, but not the nitrate plants.

The CHAIRMAN. I think that is right. Of course, the Government owns at each one of these nitrate plants a small town.

Mr. MERRILL. Yes; so I understand.

The CHAIRMAN. Consisting of residences which are modern and in good shape; and also at Dam No. 2 they have another town where their employees and officials live.

Mr. MERRILL. Yes. There is another general question that I think is worthy of consideration in connection with this whole proposition, and that is what use ought to be made, from the general public standpoint, of big power resources like that of the Tennessee River.

Colonel Keller, in his investigations of 1919 of power conditions during the war, found in the five States, Alabama, Tennessee, Georgia, and North and South Carolina, a power output of about 1,230,000,000 kilowatt hours, and he estimated at that time that an additional 1,000,000,000 kilowatt hours would be required within the next five or seven years. It has been three years since that report was prepared and the power output in the group of five States mentioned has in the meantime increased 1,400,000,000.

The CHAIRMAN. It has increased more in three years than he estimated it would increase in five years?

Mr. MERRILL. It has increased 40 per cent more in three years than he estimated it would increase from five to seven years. The output has more than doubled in those five States in the last three years and there will be necessarily an increased demand in that territory for power in the future.

I have made up a few figures here showing the output of electrical energy in that group of Southern States since 1907. Those States include, in addition to the five that I have named, Arkansas, Florida, Kentucky, Louisiana, and Mississippi, all of which are within transmission range of Muscle Shoals.

Those five States last named, in the year 1907, produced only 103,000,000 kilowatt hours of electrical energy. In 1912 they had increased it to 165,000,000; in 1917 they had gotten up to 269,000,000, and in 1921 to 850,000,000. The percentage of increase per annum are: 1907 to 1912, 32 per cent, from 1912 to 1917, 35 per cent, and from 1917 to 1921, 14 per cent.

The States of Louisiana and Mississippi, and a large portion of Florida, have no hydro power. They are dependent upon steam power at the present time and their rate of use of power is much less than it is in the five States which have hydropower; that is, Alabama, Georgia, the two Carolinas, and Tennessee. There is no doubt an opportunity largely to increase the use of electrical power in these Gulf States in the next few years by the substitution of hydropower for steam power. New Orleans is probably within practical transmission distance of Muscle Shoals; it certainly is within practical transmission distance of the southern network of the Alabama Power Co.'s transmission system. It seems to me that the best interests of the South itself will be better met if power resources, like that of the Tennessee River, are made available for general public utility use in the whole southern section, than if we repeat at Muscle Shoals what we have hitherto done at Niagara, turn an enormous resource like that to private use for manufacturing purposes for a single locality.

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The criticisms constantly brought before the Federal Power Commission, when they were handling the leases and permits for Niagara, were to the effect that it should prohibit in the future any such utilization of a great natural resource as had been done when the powers at Niagara had been devoted almost exclusively to private manufacturing operations. Demand was made by the city of Buffalo that conditions be put into any future grants that the power should be subject to public utility use in the New York industrial district, under such conditions as might be agreed upon by the Federal Power Commission and the Public Service Commission of New York State.

It is only where power resources like this can be distributed over a wide territory that you can get real industrial development, and a certain section of the South at the present time is second only to the Pacific coast in the extent to which it is producing hydroelectric energy. That section embraces the northwestern part of the Carolinas, upper Georgia and Alabama, and Tennessee. There is no reason in my judgment, why the same advantages should not accrue to the entire south, including the Gulf section, which at present has nothing except steam power, if a big resource like the Tennessee River is put into the general transmission net work, and I personally have more interest in seeing a general development of the South than the individual advantage of any applicant before this committee. Because the Alabama Power Co.'s offer not only presents what I believe is a reasonable basis for negotiating the details of a financial arrangement with the Government, but also, and primarily, because it proposes to serve the entire South with electric energy from Muscle Shoals, its offer, in my opinion, is far better than any other before you and should be given serious consideration by your committee.

Senator HEFLIN. If Mr. Ford should get Muscle Shoals and he could manufacture fertilizer on a large scale, as his representatives claim that he will, wouldn't he be developing the South considerable?

Mr. MERRILL. Yes; and we would have then, if that were a fact and if it can and would be done, a balance between these two advantages—on one you would lose and on the other you would gain.

Senator HEFLIN. Suppose he could reduce the cost of manufacturing automobiles down there and the spinning of cotton into cloth, wouldn't he be helping to build up the South?

Mr. MERRILL. No doubt he would. There is no doubt in my mind that the operations of Mr. Ford would mean advantage to the South. I do not question that. The question is whether there isn't a markedly better way, whether it is not better to develop the entire general industrial situation in that southern territory than to intensively develop one particular section.

The CHAIRMAN. And there is a question, in addition to that, Mr. Merrill, as to whether the Government should subsidize any corporation to go into any business, however legitimate it might be, by giving them advantages that nobody else can possess unless they get a subsidy from somebody.

Mr. MERRILL. My last remarks were free of any consideration of a subsidy, even if Mr. Henry Ford secured that proposition and secured it on the terms that were reasonable. I think the terms at present are utterly unreasonable.

The CHAIRMAN. I presume, from your position on the Federal Power Commission, and I judge from your testimony, that you have come, and the commission has come, in direct contact with the question that where there is power in a navigable stream that belongs to the country, the question at once arises whether you ought to permit that power to be utilized for private advantage when it could be utilized by the public; for instance, supplying cities with electrical power. In other words, as between supplying an individual or corporation for private use, admitting that it would be nice if they could have it, but between the Government giving to them the right to use water power for private use and giving it to a city for public use, you are up against that question continuously, I suppose?

Mr. MERRILL. Yes, sir.

The CHAIRMAN. And it is your judgment that, everything else being equal, when those two interests clash, that the right to the use of power which is generated from public streams ought to go to the public rather than to private corporations?

Mr. MERRILL. Yes, sir, and it goes even beyond that point, Mr. Chairman. It is a question of the use. A grant may be made to a private corporation to generate power, but to generate it and deliver it for a public use.

The CHAIRMAN. Yes.

Mr. MERRILL. I think we have no better illustration of the different methods of procedure than at Niagara on the two sides of the river. On the American side of the river we have power generated 90 per cent of which is used for manufacturing operations there, some 40,000 horsepower delivered to Buffalo for utility purposes, and the balance of it, so far as I am aware, being used solely for manufacturing purposes, and

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the people of Buffalo, one of the largest cities in the State of New York, are dependent on steam power to get the lighting in their homes and the power to run their street railways.

The CHAIRMAN. And almost in sight of the power?

Mr. MERRILL. Almost in sound of the Falls. On the other side of the river you have that power generated and put into a big transmission system under one control, spread all over the Province of Ontario, at rates which are probably not one-third of the rates which were being paid in the Province of Ontario before the hydroelectric commission went in.

The CHAIRMAN. How do those rates compare with the rates charged on this side to private consumers in the cities and villages?

Mr. MERRILL. There is not any material difference in the average price received if you take the entire output. You gentlemen, of course, have seen the report of Murray & Flood. I haven't examined it in detail, but I believe their report is approximately correct. There may be errors in detail here and there, but they say if you exclude taxes from the price received for utility power in certain sections of the United States—and they compared California with Ontario—that the rate received per kilowatt hour generated is approximately the same in the State of California and in the Province of Ontario. Their conclusion was that it was a little in favor of the State of California. But there is this difference in the situation: The domestic user in Ontario pays far less for his power on the average than is paid by the citizen of the State of California. That is the element with regard to the Ontario situation which you hear and that is the one on which propaganda is distributed; but they have a different rate structure. In the State of California rates are based on the cost of service per class of service, and they are apparently based in Ontario on the cost of service as a whole, and the distribution of the cost between the various users is a political, not an economic question at all.

The CHAIRMAN. There they have one class paying a higher rate and another class paying a lower rate.

Mr. MERRILL. Yes. The domestic user who gets his power in Ontario at a rate varying from 1.2 cents to 19 cents per kilowatt hour on an average pays less than the domestic user in the State of California; but the power user pays more. The domestic use is a very small proportion of the total, so that you can adjust your rate structure materially with respect to the domestic use and make very little difference in total receipts. The point that always sticks out in any schedule is the rate that the domestic user pays. If you can cut that rate in half or by one-third, you can say that you are doing a wonderful thing, and can then obscure every bit of it by adding a mill somewhere else. But there is this that must be said of the Ontario development, that it has markedly reduced the cost of power on the average in the Province of Ontario. It has distributed power to sections that never had it before, and it is a shining example of the different use of a great resource—one on the Ontario side distributing it for the public benefit, for the benefit of all the public within range, and one on the American side distributing it under long-term contracts for manufacturing operations with only a very small percentage available for public-utility use. Now, I do not believe that that scheme should be repeated at Muscle Shoals. I do not believe it is in the public interest to do so.

I do not know that I have anything further to say on that, Mr. Chairman.

The CHAIRMAN. Have you analyzed Mr. Engstrum's proposition?

Mr. MERRILL. Oh, yes. I had forgotten Mr. Engstrum's proposition. I think the most that can be said about Mr. Engstrum's proposition is this: That he proposes a scheme whereby the United States will put in every dollar that is invested down there and shall pay his corporation first, a 5 per cent fee for construction purposes. Now, if we consider the power plants alone, there is $17,000,000 already in, and the fee on the $50,000,000 yet to go in, would mean at least two and a half million dollars. It is proposed that the steam plants be reconstructed, which will cost another ten million; that a second nitrate plant be built at No. 3, which would probably cost $25,000,000, and that means $35,000,000 more on which a 5 per cent fee would be between one and two million dollars.

He proposes further that he shall receive as compensation for operation of the plant one-third of the proceeds—not one-third of the profits, but one-third of the proceeds—from the sale of power plant at No. 2 in excess of the requirements for operating nitrate plant No. 2 at a capacity of 110,000 tons of ammonium nitrate per annum; that he shall receive the proceeds from one-fourth of the power produced at Dam No. 3, in excess of the requirements for power at nitrate plant No. 3, nitrate plant No. 3 to have the same capacity with relation to Dam No. 3 that nitrate plant No. 2 has to Dam No. 2. That is as I recollect it. I have seen his proposal only in the stenographic report. He has modified it to such an extent that the original and that report are not comparable.

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If we assume, therefore, that development is made to the extent proposed by Mr. Ford, 850,000 installation at the two dams, producing 3,000,000,000 kilowatt hours, there should be available for sale from Dam No. 2, after meeting the requirements of nitrate plant No. 2, 1,400,000,000 kilowatt hours, and from Dam No. 3, after meeting the requirements of nitrate plant No. 3, 600,000,000 kilowatt hours. If we assume that this power may be sold at 4 mills a kilowatt hour, one-third of the proceeds of the surplus power at Muscle Shoals would be $1,870,000 per annum, and one-fourth of the proceeds from Dam No. 3 would be $600,000 per annum, or a total of $2,470,000. Now, it is very possible that he can get 4 mills for this power, because he is going to sell primary power and use secondary to operate his nitrate plants, as I understand his plan. In addition he is to have the profit on one-fourth of the fertilizer compounds, or is to have a certain amount of the profits, anyway, on the fertilizer compounds, and he is to have the proceeds from the sale of 25 per cent of the by-products. Now, I do not know anything about what that would amount to. We can assume, however, that if this scheme goes through and if it is developed up to the full capacity of the stream for hydropower that he ought to get at least $3,000,000 per annum out of it under the terms of his offer, which is a fairly good sized fee for operating the works.

Now, as I understand his offer, he does not propose to operate the nitrate plants from his hydropower available for the purpose, but that he would only operate to the extent that the receipts from the sale of power, fertilizer, and by-products leaves a sum available for operation, except, I believe, that he would make a modification to this effect—I think this was made a few days ago—that at the beginning the corportation would advance the moneys necessary for starting the operation of these plants, subject to having the money returned at the earliest possible date.

The CHAIRMAN. And another modification, I think, was that he agreed to pay 20 per cent of his profits.

Mr. MERRILL. Twenty per cent of his share of the receipts from the sale of power, if necessary.

The CHAIRMAN. If necessary, yes. Whenever there isn't enough money in the other funds to operate the plants he will put in 20 per cent of his share of the proceeds from the sale of power.

Mr. MERRILL. Now, the question arises here what is meant by operating expenses. I haven't the exact language here, but operating expenses to include maintenance, repairs, renewals, but not to include salaries to officers, directors, etc. I see nowhere in the proposition that the interest charges on the investment should be considered an operating expense, or any proposal anywhere in the Engstrum offer, anything that will not make the interest charges an obligation on the United States Treasury. I see nothing which indicates that interest charges are to be considered in any respect in connection with the operation of the nitrate plants and the power plants.

Again, operating expenses for this initial period are to be increased, or rather the operating fund is to be increased, by whatever amount the United States may get from the sale of the Gorgas steam plant or its interest in the Gorgas steam plant.

Now, we would have approximately this situation, looking at it from a financial standpoint, in regard to the Engstrum proposal.

There is an investment at Muscle Shoals in connection with the nitrate plants and power plants of $105,000,000 in round numbers. There is proposed to be invested, new money, in the construction of power plant No. 3 and the completion of power plant No. 2, $50,000,000. Mr. Engstrum proposes to reconstruct the steam plant at Sheffield, to add about 30,000 kilowatts more, at a cost that we will say is ten million. He proposes that when power plant No. 3 is completed there shall be built a nitrate plant No. 3 which will bear the same relation in capacity to dam No. 3 that the present plant does to Dam No. 2. Suppose we call that $25,000,000. There will then be a total investment of United States funds of $190,000,000. Now, that property will not have a reproduction value of that amount, because the investment in nitrate plants is much greater, presumably, than would have been required if construction was undertaken at present. I have assumed that the reproduction value of the power plants, the major part of which will be new investment, is $65,000,000, that the reproduction value of nitrate plant No. 2 is $25,000,000, and the reproduction value of nitrate plant No. 3, which would be new, $25,000,000, giving a total of $115,000,000. Therefore, if this is to be handled as a business proposition, the balance of $75,000,000 which apparently would be in there if the proposal of Mr. Engstrum should be accepted should be amortized—be wiped out as a capital expense during the term of the lease. The annual interest charges on the reproduction value, as assumed by these figures, would amount to $4,160,000 per annum. If the $75,000,000 of excess cost over valuation is to be amortized over a period of 50 years at 4 per cent, paying interest in the meantime on the deferred balance, that would add $3,490,000. There

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is no provision in the Engstrum proposal for depreciation other than that which may be represented by renewals of operating property. I have assumed that of all the investment in power plant, taken at $65,000,000, $25,000,000 represents practically all the property subject to fairly rapid depreciation, that that figured at 3 per cent per annum would give a depreciation charge of $750,000. The balance I have figured at one-half of 1 per cent, or $200,000.

Fifty million dollars is to be invested in two nitrate plants, which, I understand, is rapidly depreciable property. If we applied 4 per cent depreciation upon that, we have $2,000,000 more, or the depreciation requirements of the investment would be $2,950,000 per annum. I have assumed that of that $2,950,000, $1,500,000 would be taken up in operating charges as renewals, which would leave then the liability of the United States for interest, amortization, and depreciation approximately $9,000,000 per annum under the Engstrum proposal.

The CHAIRMAN. What is that?

Mr. MERRILL. $9,000,000 per annum for interest, depreciation, and amortization and not a dollar of that, so far as I can see, is covered in the Engstrum proposal.

The CHAIRMAN. There was still another proposition that I do not suppose was submitted to you.

Mr. MERRILL. You mean the Parsons offer?

The CHAIRMAN. Yes.

Mr. MERRILL. I have not really considered the Parsons offer, because it covers such a small part of the proposition that I supposed it would not be considered.

The CHAIRMAN. Have you examined the bill that I have introduced?

Mr. MERRILL. I have just glanced through it, Mr. Chairman.

The CHAIRMAN. Are you prepared to make any comment on it?

Mr. MERRILL. Any comments I would make would just be along general lines.

The CHAIRMAN. I would be glad if you would examine that and come before us again, before we get through, and give us your ideas on it.

Mr. MERRILL. I have this general feeling about the whole situation, that it is advisable for the Government to keep out of business operations unless it is forced into them by considerations which are beyond its control. That is, because the alternative is worse. There are certain rather serious difficulties in government operation which I see not only in connection with the Federal Government but in connection with municipal and State governments when they enter into business enterprises. One is that, do the best that you can, you can not keep a government operation out of politics. There is always a certain amount of politics that enters into it. Secondly, you can never get a legislative body, whether the Congress of the United States or a State legislature or a city council, into a position where they are willing to pay the prices for competent men. Those two, I think, are the major reasons why we have not done better in this country than we have done in matters of public ownership and operation.

The CHAIRMAN. In this bill I have recognized, as of course I have recognized outside of it, that anything of that kind operated by the Government must be kept out of politics or it will be a failure. I think I have covered that in the drawing of this bill.

Mr. MERRILL. I think you have gone as far as you possibly could go. I think if the Government is going into a business operation of any kind that it had better go into it as a stockholder in a corporation rather than going into it as a direct operator; but at the very start you have politics in the appointment of your boards of directors and you you can not avoid it.

The CHAIRMAN. Not any more than you would have politics in the appointment of members of the Supreme Court?

Mr. MERRILL. No; possibly not.

The CHAIRMAN. I think that has been kept pretty free of politics. I have never heard the charge that there was any politics there.

Mr. MERRILL. I do not think I would quite admit that, Mr. Chairman, because of the fact that there are a great many people who do not respect other things who have a degree of respect for the Supreme Court and the sanctity of that court that they would not feel for a corporation of the United States.

The CHAIRMAN. That may be.

Senator HEFLIN. I think that is right.

The CHAIRMAN. I realize the danger and I know the evils of it, and I am trying to avoid it. If the bill I have introduced can be amended in any way, so as to make it more completely outside of the control of politics, I would like to have it done. I realize this, that the President might appoint and the Senate might confirm men who would constitute the board of directors of a governmental corporation who would make a failure of it. I know that may be true. I do not know how to escape that. I do not think the President would do it, however, because I do not think the under-

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standing could be any clearer that he should get men outside of political consideration, and once they get in and are confirmed, I do not see how they can be controlled by any political consideration. I agree that the bill might be amended so as to get it away from Congress. That is one of the objections that Mr. Merrill makes, and it is a good one, that legislative bodies can not handle these things. They must decide questions of politics. I want to put this corporation where it will get a return for the sale of power; where it can control itself; where it can operate and do everything that any other corporation can do and be subject to the same liabilities and everything.

Of course Congress could repeal the law and put it out of existence; that is true.

(Appendix to the testimony of O. C. Merrill is here printed in full, as follows:)

APPENDIX.

Summary of financial aspect of Henry Ford's Muscle Shoals offer, with interest on Government bonds from date of completion of Dam No. 2 until termination of lease taken at 4 per cent and at 3 per cent, and an assumption A, interest during construction not included in cost; assumption B, interest during construction included in cost.

	Summary and comparison of items payable and items receivable.					
	With Government bonds after 1928 at 4 per cent.			With Government bonds after 1928 at 3 per cent.		
	Dam No. 2.	Dam No. 3.	Both.	Dam No. 2.	Dam No. 3.	Both.
ASSUMPTION A.						
Interest receivable	$95,200,000	$97,480,000	$192,680,000	$95,200,000	$97,480,000	$192,680,000
Interest payable	172,170,960	110,637,140	282,808,100	130,619,120	83,442,780	214,061,900
Amortization receivable	3,735,180	679,970	4,415,150	3,735,180	679,970	4,415,150
Amortization payable	3,888,220	2,325,280	6,213,500	3,888,220	2,325,280	6,213,500
Excess of interest payable	76,970,960	13,157,140	90,128,100	35,419,120	14,037,220	21,381,900
Excess of amortization payable	153,040	1,645,310	1,798,350	153,040	1,645,310	1,798,350
Excess of items payable	77,124,000	14,802,450	91,926,450	35,572,160	12,391,910	23,180,250
ASSUMPTION B.						
Interest receivable	95,200,000	97,480,000	192,680,000	95,200,000	97,480,000	192,680,000
Interest payable	189,942,000	116,179,100	306,121,100	142,456,880	87,134,360	229,591,240
Amortization receivable	3,735,180	679,970	4,415,150	3,735,180	679,970	4,415,150
Amortization payable	4,443,380	2,483,390	6,926,770	4,443,380	2,483,390	6,926,770
Excess of interest payable	94,742,000	18,699,100	113,441,100	47,256,880	10,345,640	36,911,240
Excess of amortization payable	708,200	1,803,420	2,511,620	708,200	1,803,420	2,511,620
Excess of items payable	95,450,200	20,502,520	115,952,720	47,965,080	8,542,220	39,422,860

	Value as of various dates of items payable and items receivable.					
	With Government bonds after 1928 at 4 per cent.			With Government bonds after 1928 at 3 per cent.		
	July 1, 1922.	July 1, 1925.	July 1, 2025.	July 1, 1922.	July 1, 1925.	July 1, 2025.
ASSUMPTION A.						
Interest receivable	$35,590,040	$40,033,950	$2,021,383,000	$35,590,040	$40,033,950	$2,021,383,000
Interest payable	63,583,500	71,522,790	3,736,616,000	49,469,800	55,648,790	2,903,707,000
Amortization receivable	785,860	883,980	48,110,000	785,860	883,980	48,110,000
Amortization payable	1,099,020	1,236,250	69,092,000	1,099,020	1,236,250	69,092,000
Excess of interest payable	27,993,460	31,488,840	1,715,233,000	13,879,760	15,612,840	882,324,000
Excess of amortization payable	313,160	352,270	20,982,000	313,160	352,270	20,982,000
Excess of items payable	28,306,620	31,841,110	1,736,215,000	14,192,920	15,965,110	903,306,000
ASSUMPTION B.						
Interest receivable	35,590,040	40,033,950	2,021,383,000	35,590,040	40,033,950	2,021,383,000
Interest payable	62,904,320	70,821,290	3,715,849,000	47,223,240	53,119,720	2,786,887,000
Amortization receivable	785,860	883,980	48,110,000	785,860	883,980	48,110,000
Amortization payable	1,225,740	1,378,790	76,915,000	1,225,740	1,378,790	76,915,000
Excess of interest payable	27,374,280	30,792,340	1,694,466,000	11,633,200	13,085,770	765,504,000
Excess of amortization payable	439,880	494,810	28,805,000	439,880	494,810	28,805,000
Excess of items payable	27,814,160	31,287,150	1,723,271,000	12,073,080	13,580,580	794,309,000

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Memorandum on financial aspects of Henry Ford's offer for Muscle Shoals.

[Detailed computations.]

I. DAM NO. 2.

1. Financial statement (Annual Report Chief of Engineers):

Expenditures:		
1918	$51,122.94	
1919	1,238,423.65	
1920	6,404,527.41	
1921	7,840,676.94	
		$15,534,750.94
Gross sales		255,922.52
Net expenditures		15,278,828.62
Liabilities, current		243,394.51
Uncompleted contracts		1,238,465.95
Total		16,760,689.08
"Total expenditures" as reported by Secretary of War, Feb. 1, 1922		16,251,038.14
Allotments (Annual Report Chief of Engineers):		
1918	$13,152,177.29	
1919	7,433.13	
1920	4,000,000.00	
Total		$17,159,610.42

2. Assumption respecting completion, etc.:

Cost to complete in addition to expenditures and obligations already incurred	25,000,000

Time for completion, 3 years 4 months (Chief of Engineers).
Begin new construction on September 1, 1922.
One hundred thousand horsepower available on July 1, 1925.
Complete construction on December 31, 1925.
Lease to run for 100 years from July 1, 1925.
First interest "receivable" on June 30, 1926; rate, 4 per cent per annum, paid annually, not compounded.
First amortization "receivable" on June 30, 1932, paid semiannually and compounded at rate of 4 per cent per annum.
First interest payable: (a) Interest during construction on December 31, 1918; rate, 4½ per cent per annum, paid semiannually, not compounded; (b) interest on completed project on June 30, 1926; average rate, 4 per cent per annum, paid semiannually, not compounded.
First amortization "payable" on June 30, 1932; paid semiannually, and compounded at rate of 4 per cent per annum.
Interest credited at 4½ per cent per annum on "gross sales."

3. Schedule of expenditures and interest during construction:

A. On expenditures of $16,251,040 already made:

Expended, fiscal year 1918, $51,120—		
Interest for average of 6 months	$1,150	
Interest from July 1, 1918, to Sept. 1, 1922 [1] (4⅛ years)	9,580	
		$10,730
Expended, fiscal year 1919, $1,238,420—		
Interest for average of 6 months	27,860	
Interest from July 1, 1919, to Sept. 1, 1922 (3⅛ years)	176,470	
		204,339
Expended, fiscal year 1920, $6,404,530—		
Interest for average of 6 months	144,100	
Interest from July 1, 1920, to Sept. 1, 1922 (2⅛ years)	624,400	
		768,500
Expended, fiscal year 1921, $7,840,680—		
Interest for average of 6 months	176,420	
Interest from July 1, 1921, to Sept. 1, 1922 (1⅛ years)	411,640	
		588,060

[1] Assumed date of execution of contract.

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A. On expenditures of $16,251,040 already made—Continued.		
Expended, fiscal year 1922, $716,290 [1]—		
Interest for 3 months (1921, half year average)	$8,060	
Interest from Jan. 1 to Sept. 1, 1922 (8 months)	21,490	
		$29,550
Total		1,601,210
Less interest at 4 per cent per average of 2 years on "gross sales" of $255,922		23,030
Total interest on $16,251,040 to Sept. 1, 1922 (assumed date of execution of contract)		1,578,180
Interest on same from Sept. 1, 1922, to Dec. 31, 1925 (assumed date of completion) (3½ years)		2,437,660
Total interest on expenditures to date until assumed date of completion		4,015,840
B. On estimated further expenditures of $25,509,650:		
Balance of calendar year 1922, $309,650— [2]		
Interest for average of 2 months	$22,570	
Interest from Dec. 31, 1922, to Dec. 31, 1925 (3 years)	406,300	
		428,870
Calendar year 1923, $7,500,000—		
Interest for average of 6 months	168,750	
Interest from Dec. 31, 1923, to Dec. 31, 1925 (2 years)	675,000	
		843,750
Calendar year 1924, $7,500,000—		
Interest for average of 6 months	168,750	
Interest from Dec. 31, 1924, to Dec. 31, 1925 (1 year)	337,500	
		506,250
Calendar year 1925, $7,500,000—		
Interest for average of 6 months		168,750
Total		1,947,620
C. Total cost to Dec. 31, 1925:		
Expenditures to Feb. 1, 1922		16,251,040
Estimated future expenditures		25,509,650
Total cash cost		41,760,690
Total interest during construction		5,963,460
Total actual cost		47,724 150
4. Interest receivable:		
6 years, at $200,000 per annum		1,200,000
94 years, at 1,000,000 per annum		94,000,000
Total		95,200,000

5. Interest payable:

Computed on two different assumptions as follows:

(A) That interest-bearing obligations on account of Dam No. 2 outstanding on date of completion only to extent of capital expenditures of $16,251,040 plus $25,509,650 or $41,760,690.

(B) That interest during construction is part of cost, subject to subsequent interest charges.

A. Interest from Dec. 31, 1925 (assumed date of completion) to July 1, 2025 (date of expiration of lease), 99½ years, at 4 per cent, on $41,760,690	$166,207,500
Interest prior to Dec. 31, 1925	5,963,460
Total interest payable	172,170,960

[1] Difference between expenditures reported to July 1, 1921, by Chief of Engineers and amount ($16,251,040) reported as expended to Feb. 1, 1922, by Secretary of War.

[2] $2,500,000 new construction plus $509,650 of liabilities and uncompleted contracts; i. e., difference between $16,760,690 and $16,251,040.

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B. Interest prior to completion considered as part of investment cost.

Interest charges from Dec. 31, 1925, to July 1, 2025, 99½ years, at 4 per cent, on $47,724,150 would make	$189,942,000

(Total interest payments by United States.)

6. Excess of interest payable over interest receivable:

Assumption A:	
Interest payable	$172,170,960
Interest receivable	95,200,000
Excess	76,970,960
Assumption B:	
Interest payable	189,942,000
Interest receivable	95,200,000
Excess	94,742,000

7. Mr. Ford's average interest payment of $952,000 per annum on account of Dam No. 2 would be 3.81 per cent on estimated cost of completion ($25,000,000); 2.28 per cent on the estimated actual cash expenditure for the completed dam ($41,760,690); and 2 per cent upon the estimated actual cost ($47,724,150) including estimated interest during construction.

By the original offer of July 8, 1921, Mr. Ford agreed to pay interest as follows:

6 years, at $200,000	$1,200,000
94 years, at $1,200,000	112,800,000
Total	114,000,000

or $18,800,000 more than his present offer (if costs are as assumed in the preceding), an average difference of $188,000 per annum.

8. Amortization receivable:

Assuming the preceding construction schedule, Mr. Ford would begin making payments to the United States for purposes of amortization on July 1, 1932, at the rate of $19,868 semiannually, continuing the same for 94 years, or 188 semiannual payments. These payments, with compound interest at 4 per cent (semiannually at 2 per cent) would amount to—

$19,868×2,019,225 [1]	$40,117,960
or less than estimated cash cost by	1,642,730
and less than estimated actual cost, including interest during construction, by	7,606,190
The sum of all amounts received would be $19,868×188	3,735,180

9. Amortization payable:

If the United States should amortize the cost of the dam and accessories in accordance with the schedule proposed by Mr. Ford and at the same rate of interest, 4 per cent, the semiannual payments required would be:

Assumption A: $41,760,690×2,019,225	$20,682
Assumption B: $47,724,150÷2,019,225	23,635
and the sum of all the amounts payable would be:	
Assumption A: $20,682×188	3,888,220
Assumption B: $23,635×188	4,443,380

[1] The amount to which $1 per annum (or per fixed period) for "n" years (or periods) will accumulate at a given rate of interest, "i," per annum (or per period) is expressed by the formula—

$$A_n = \frac{(1+i)^n - 1}{i}$$

$$(1+i)^n = (1.02)^{188}$$

$\log (1+i)^n = \log (1.02)^{188} = 188 \log 1.02 = 188 \times 0.0086002 = 1.6168376$, for which corresponding number is 41.3845

$$A_{188} = \frac{41.3845 - 1}{0.02} = 2019.225$$

With n=194,

$\log (1+i)^n = 194 \times 0.0086002 = 1.6684388$, for which corresponding number is 46.60568

$$A_{194} = \frac{46.60568 - 1}{0.02} = 2280.284$$

Logarithms from Vega's seven place tables.

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10. Excess of amortization payable over amortization receivable:

Assumption A:	
Per semiannum, $20,682—$19,868	$814
Lease period, $3,888,220—$3,735,180	153,040
Assumption B:	
Per semiannum, $23,635—$19,868	3,767
Lease period, $4,443,380—$3,735,180	708,200

11. Excess of items payable over items receivable:

Assumption A:	
Interest excess	$76,970,960
Amortization excess	153,040
Total	77,124,000
Assumption B:	
Interest excess	94,742,000
Amortization excess	708,200
Total	95,450,200

II. DAM NO. 3.

12. Assumption respecting completion, etc.:
Cost of construction, $25,000,000.
Cost of lands and rights of way, $2,331,000.
Time for completion, three years.
Begin construction upon completion of Dam No. 2, i. e., on January 1, 1926.
Eighty thousand horsepower available on July 1, 1928.
Complete construction on December 31, 1928.
Lease to run for 100 years from July 1, 1928.
First interest "receivable" on June 30, 1929; rate, 4 per cent per annum, paid annually, not compounded.
First amortization "receivable" on June 30, 1932, paid semiannually and compounded at rate of 4 per cent per annum.
First interest rate payable:
(*a*) Interest during construction on June 30, 1926; rate 4½ per cent per annum, paid semiannually, not compounded.
(*b*) Interest on completed project on June 30, 1929, average rate 4 per cent per annum, paid semiannually, not compounded.
First amortization "payable" on June 30, 1932; paid semiannually and compounded at rate of 4 per cent per annum.

13. Schedule of expenditures and interest during construction:

A. On estimated expenditure of $27,331,000:

Calendar year 1926	$9,331,000	
Interest for 6 months	209,950	
Interest from Dec. 31, 1926, to Dec. 31, 1928 (2 years)	839,790	
		$1,049,740
Calendar year 1927	9,000,000	
Interest for 6 months	202,500	
Interest from Dec. 31, 1927, to Dec. 31, 1928 (1 year)	405,000	
		607,500
Calendar year 1928	9,000,000	
Interest for 6 months		202,500
Total of interest during construction		1,859,740

B. Total cost to Dec. 31, 1928:

Construction of works	25,000,000
Lands and flowage rights	2,331,000
Total cash cost	27,331,000
Interest during construction	1,859,740
Total actual cost	29,190.740

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14. Interest receivable:

3 years at $160,000 per annum	$480,000
97 years at $1,000,000 per annum	97,000,000
Total	97,480,000

15. Interest payable:

Computed on two assumptions, as follows: (A) That interest-bearing obligations on account of Dam No. 3 outstanding only to extent of capital expenditures of $27,331,000; (B) that interest during construction is part of cost subject to subsequent interest charges.

A. Interest from Dec. 31, 1928 (assumed date of completion), to July 1, 2028 (date of expiration of lease), 99½ years at 4 per cent on $27,331,000.	$108,777,400
Interest prior to Dec. 21, 1928	1,859,740
Total interest payments by United States	110,637,140
B. Interest during construction considered as part of investment cost, interest charges from Dec. 31, 1928, to July 1, 2028, 99½ years at 4 per cent on $29,190,740, would make	116,179,100

16. Excess of interest payable over interest receivable:

Assumption A:	
Interest payable	$110,637,140
Interest receivable	97,480,000
Excess	13,157,140
Assumption B:	
Interest payable	116,179,100
Interest receivable	97,480,000
Excess	18,699,100

17. Mr. Ford's average interest payment of $974,800 per annum on account of Dam No. 3 is 3.90 per cent on the estimated cost of structures ($25,000,000), 3.57 per cent on the estimated cost of structures, land, and flowage ($27,331,000), and 3.34 per cent on the estimated actual total ($29,190,740), including interest during construction.

By the original offer of July 8, 1921, Mr. Ford agreed to pay interest as follows:

3 years at $160,000 per annum	$480,000
97 years at $480,000 per annum	46,560,000
Total	47,040,000

Or $50,440,000 less than his present offer (if costs are as assumed in the preceding); an average difference of $504,400 per annum.

18. Amortization receivable:

Assuming the preceding construction schedule Mr. Ford would begin making payments to the United States for purposes of amortization on July 1, 1932, at a rate of $3,505 semiannually, continuing the same for 97 years or 194 semiannual payments. These payments with compound interest at 4 per cent (semiannually at 2 per cent) would amount to: $3,505×$2,280.284 [1], $7,992,400, or less than the estimated cash cost by $19,338,600, and less than the estimated actual cost including interest during construction by $21,198,340. The sum of all amounts received would be: $3,505×194=$679,970.

19. Amortization payable:

If the United States should amortize the cost of the dam and accessories in accordance with the schedule proposed by Mr. Ford and at the same rate of interest, 4 per cent, the semiannual payments would be:

Assumption A: $27,331,000÷2,280.284=$11,986. Assumption B: $29,190,740÷2,280.284=$12,801, and the sum of all the amounts payable would be: Assumption A: $11,986×194=$2,325,280. Assumption B: $12,801×194=$2,483,390.

20. Excess of amortization payable over amortization receivable:

Assumption A:	
Per semiannum, $11,986−$3,505	$8,481
Lease period, $2,325,280−$679,970	1,645,310
Assumption B:	
Per semiannum, $12,801−$3,505	9,296
Lease period, $2,483,390−$679,970	1,803,420

[1] See note to page 5 preceding.

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21. Excess of items payable over items receivable:

Assumption A:	
Interest excess	$13,157,140
Amortization excess	1,645,310
Total	14,802,450
Assumption B:	
Interest excess	18,699,100
Amortization excess	1,803,420
Total	20,502,520

III. SUMMARY OF DAMS NO. 2 AND NO. 3.

22. Cost:

Assumption A:	
Dam No. 2	$41,760,690
Dam No. 3	27,331,000
Total	69,091,690
Assumption B:	
Dam No. 2	47,724,150
Dam No. 3	29,190,740
Total	76,914,890

23. Interest receivable:

Dam No. 2	$95,200,000
Dam No. 3	97,480,000
Total	192,680,000

Or $1,926,800 per annum.

24. Interest payable:

Assumption A:	
Dam No. 2	$172,170,960
Dam No. 3	110,637,140
Total	282,808,100

Or $2,828,080 per annum.

Assumption B:	
Dam No. 2	$189,942,000
Dam No. 3	116,179,100
Total	306,121,100

Or $3,061,210 per annum.

25. Excess of interest payable over interest receivable:

Assumption A:	
Dam No. 2	$76,970,960
Dam No. 3	13,157,140
Total	90,128,100

Or $901,280 per annum.

Assumption B:	
Dam No. 2	$94,742,000
Dam No. 3	18,699,100
Total	113,441,100

Or $1,134,410 per annum.

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26. Amortization receivable, lease period:

Dam No. 2	$3,735,180
Dam No. 3	679,970
Total	4,415,150

Or $23,373 per semiannum.

27. Amortization payable:

Assumption A:

Dam No. 2	$3,888,220
Dam No. 3	2,325,280
Total	6,213,500

Or $32,668 per semiannum.

Assumption B:

Dam No. 2	$4,443,380
Dam No. 3	2,483,390
Total	6,926,770

Or $36,436 per semiannum.

28. Excess of amortization payable over amortization receivable:

Assumption A:

Dam No. 2	$153,040
Dam No. 3	1,645,310
Total	1,798,350

Or $9,295 per semiannum.

Assumption B:

Dam No. 2	708,200
Dam No. 3	1,803,420
Total	2,511,620

Or $13,063 per semiannum.

29. Excess of items payable over items receivable:

Assumption A:

Dam No. 2	$77,124,000
Dam No. 3	14,802,450
Total	91,926,450

Or average of $919,260 per annum.

Assumption B:

Dam No. 2	$95,450,200
Dam No. 3	20,502,520
Total	115,952,720

Or average of $1,159,530 per annum.

IV. "PRESENT WORTH" OF ITEMS PAYABLE AND ITEMS RECEIVABLE.

AS OF JULY 1, 1925, DATE OF BEGINNING OF LEASE PERIOD FOR DAM NO. 2.

30. To find the value as of July 1, 1925 (date of beginning of "lease period" of Dam No. 2), of the proposed payments by Mr. Ford of interest and amortization and of corresponding costs to United States on assumption cost of properties amortized at end of lease period. Interest payments under lease to be made annually on July 1 for the preceding year and interest payments by the United States semiannually on July 1 and January 1 for the preceding half year.

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31. Interest receivable:

Dam No. 2:		
First payment, $200,000 on July 1, 1926, 5 succeeding payments of same amount at 12-month intervals; value as of July 1, 1925, $200,000×5.2421388 [1]		$1,048,430
$1,000,000 on July 1, 1932, and on each succeeding July 1, for 94 payments; value as of July 1, 1931, $1,000,000 × 24,37371989 = $24,373,720; value as of July 1, 1925, $24,373,720×0.7903152		19,262,920
Total		20,311,350
Dam No. 3:		
First payment, $160,000 July 1, 1929, two succeeding payments of same amount at 12-month intervals; value as of July 1, 1928, $160,000×2.7750910=$444,015; value as of July 1, 1925, $444,015×0.8889964		394,730
$1,000,000 on July 1, 1932, and on each succeeding July 1 for 97 payments; value as of July 1, 1931, $1,000,000×24.44324588= $24,443,246; value as of July 1, 1925, $24,443,246×0.7903152		19,317,870
Total		19,712,600
Grand total value of interest receivable		40,033,950

32. Interest payable:

Assumption A. Interest during construction not included in cost, but values of interest during construction computed on assumption that amounts heretofore taken for any year payable one-half at end of each six months period:		
Dam No. 2, cash cost, $41,760,690; interest during construction, with value as of July 1, 1925—		
Payable on Dec. 31, 1918 (6½ years)	$13,360	
Value, $13,360×1.02×1.265318		$17,240
Payable on June 30, 1919 (6 years)	12,210	
Value, $12,210×1.265318		15,450
Payable on Dec. 31, 1919 (5½ years)	96,760	
Value, $96,760×1.02×1.216652		120,010
Payable on June 30, 1920 (5 years)	96,760	
Value, $96,760×1.216652		117,720
Payable on Dec. 31, 1920 (4½ years)	257,010	
Value, $257,010×1.02×1.169858		306,680
Payable on June 30, 1921 (4 years)	256,950	
Value, $256,950×1.169858		300,600
Payable on Dec. 31, 1921 (3½ years)	357,590	
Value, $357,590×1.02×1.124864		410,280
Payable on June 30, 1922 (3 years)	366,240	
Value, $366,240×1.124864		411,970
Payable on Dec. 31, 1922 (2½ years)	387,630	
Value, $387,630×1.02×1.081600		427,650
Payable on June 30. 1923 (2 years)	517,720	
Value, $517,720×1.081600		559,970
Payable on Dec. 31, 1923 (1½ years)	517,750	
Value, $517,750×1.02×1.04		549,230
Payable on June 30, 1924 (1 year)	686,490	
Value, $686,490×1.04		713,950
Payable on Dec. 31, 1924 (½ year)	686,500	
Value, $686,500×1.02		700,230
Payable on June 30, 1925	855,240	
Value		855,240
Payable on Dec. 31, 1925 (½ year)	855,250	
Value, $855,250×0.980392		838,480
Total	5,963,460	6,344,700

[1] Tabular values for $1 for periods of 100 or less from Zaldari's "Annuities and amortization tables," 1917; for periods in excess of 100 computed from formulæ with Vega's 7-place logarithmic tables.

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Assumption A. Interest during construction not included in cost, but values of interest during construction computed on assumption that amounts heretofore taken for any year payable one-half at end of each six months period—Con.		
Dam No. 2 cash cost, $41,760,690; interest during construction, with value as of July 1, 1925—Continued.		
Value as of Dec. 31, 1925, of 199 interest payments of $835,213.80 made semiannually from said date to and including July 1, 2025; said amount being the semiannual interest ot 4 per cent on the cash cost of $41,760,690, is $835,213.80×49.028305 [1]= $40,949,120; value as of July 1, 1925=$40,949,120× 0.9803920		$40,146,190
Total value of interest payable on Dam No. 2		46,490,890
Dam No. 3, interest during construction with values as of July 1, 1925—		
Payable on June 30, 1926 (−1 year)	$104,970	
Value, $104,970×0.9615384		$100,930
Payable on Dec. 31, 1926 (−1½ years)	104,980	
Value, $104,980×0.980392×0.9615384		98,960
Payable on June 30, 1927 (−2 years)	311,200	
Value, $311,200×0.9245562		287,720
Payable on Dec. 31, 1927 (−2½ years)	311,200	
Value, $311,220×0.980392×0.9245562		282,100
Payable on June 30, 1928 (−3 years)	513,700	
Value, $513,700×0.8889964		456,680
Payable on Dec. 31, 1928 (−3½ years)	513,690	
Value, $513,690×0.980392×0.8889964		447,700
Total	1,859,740	1,674,090
Value as of Dec. 31, 1928, of 199 interest payments of $546,620 made semiannually from said date to and including July 1, 2028, said amount being the semiannual interest at 4 per cent per annum on the estimated cash cost of $27,331,000 is $546,620× 49.028305=$26,799,850.		
Value as of Dec. 31, 1925, is $26,799,850×0.8889964	23,824,970	
Value as of July 1, 1925, is $23,824,970×0.9803920		23,357,810
Total value of interest payable on Dam No. 3		25,031,900
Grand total value of interest payable on No. 2 and No. 3		71,522,790
Assumption B. Interest during construction included in cost: Dam No. 2, cost with interest, $47,724,150—		
Value as of Dec. 31, 1925, of 199 interest payments of $954,483 made semiannually from said date to and including July 1, 2025, said amount being the semiannual interest at 4 per cent per annum on the above cost, $954,483=49.028305=$46,796,690.		
Value as of July 1, 1925=$46,796,690=0.9803920		45,879,100

[1] This quantity determined as follows:

Present value of $1, payable in 99½ years, with interest compounded semiannually at 4 per cent, is same as $1 payable in 199 years, with interest compounded annually at 2 per cent. The formula is:

$$V_n=(1+i)^{-n} \text{ or } V_n=\frac{1}{1.02^{199}}$$

$$\log. 1.02^{199}=199 \log. 1.02$$
$$\log. 1.02=0.0086092$$
$$199 \log. 1.02=1.7114398$$
Corresponding number=51.45644
$$1+51.45644=0.0194339$$
$$V_n=0.0194339$$

The value of $1 semiannually for 99½ years, with interest compounded semiannually at 4 per cent, is same as $1 annually for 199 years, with interest compounded annually at 2 per cent. The formula is:

$$A_n=\frac{1-V_n}{i}=\frac{1-0.0194339}{0.02}=49.028305.$$

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Assumption B. Interest during construction included in cost—Continued.

Dam No. 3—Cost with interest $29,190,740—

Value as of Dec. 31, 1928, of 199 interest payments of $583,814 made semiannually from said date to and including July 1, 2028, said amount being the semiannual interest at 4 per cent per annum on the above cost is $583,814.80×49.028305=$28,623,450.

Value as of Dec. 31, 1925=$28,623,450×0.8889964=$25,446,140.

Value as of July 1, 1925=25,446,140×0.9803920..... $24,947,190

Grand total value of interest payments on No. 2 and No. 3.... 70,826,290

33. Excess of interest payable over interest receivable:

Assumption A..... 31,488,840

Assumption B..... 30,792,340

34. Amortization receivable:

Dam No. 2:

Value as of Dec. 31, 1931, of 188 semiannual payments of $19,868 beginning on July 1, 1932, is $19,868×48.7918 [1]=$969,400.

Value as of Dec. 31, 1925 is $969,400×0.7903152=$766,130.

Value as of July 1, 1925=$766,130×0.9803920..... 751,110

Dam No. 3:

Value as of Dec. 31, 1931, of 194 semiannual payments of $3,505 beginning on July 1, 1932, is $3,505×48.92717 [2]=$171,490.

Value as of Dec. 31, 1925, is $171,490×0.7903152=$135,530.

Value as of July 1, 1925=$135,530×0.9803920..... 132,870

Total value of amortization receivable..... 883,980

35. Amortization payable:

Assumption A:

Dam No. 2—

Value as of Dec. 31, 1931, of 188 semiannual payments of $20,682, beginning on July 1, 1932, is $20,682×48.7918=$1,009,110; value as of Dec. 31, 1925, is $1,009,110×0.7903152=$797,510; value as of July 1, 1925=$797,510×0.9803920..... 781,870

Dam No. 3—

Value as of Dec. 31, 1931, of 194 semiannual payments of $11,986, beginning on July 1, 1932, is $11,986×48.92717=$586,440; value as of Dec. 31, 1925, is $586,440×0.7903152=$463,470; value as of July 1, 1925=$463,470×0.9803920..... 454,380

Total..... 1,236,250

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[1] $V^n=(1+i)^{-n}=\frac{1}{1.02^{188}}$

log. 1.02=0.0086002.
188×0.0086002=1.6168376.
Corresponding number is 41.3845.
1÷41.3845=0.0241636.

$A_n=\frac{1-V^n}{i}=\frac{1-0.0241636}{0.02}=48.79182.$

[2] $V^n=(1+i)^{-n}=\frac{1}{1.02^{194}}$

log. 1.02=0.0086002.
194×0.0086002=1.6684388.
Corresponding number is 46.60568.
1÷46.60568=0.0214566.

$A_n=\frac{1-V^n}{i}=\frac{1-0.0214566}{0.02}=48.92717.$

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Assumption B:	
Dam No. 2—	
Value as of Dec. 31, 1931, of 188 semiannual payments of $23,635, beginning on July 1, 1932, is $23,635×48.7918=$1,153,190; value as of Dec. 31, 1925, is $1,153,190×0.7903162=$911,380; value as of July 1, 1925, is $911,380×0.9803920	$893,510
Dam No. 3—	
Value as of Dec. 31, 1931, of 194 semiannual payments of $12,801, beginning on July 1, 1932, is $12,801×48.92717=$626,320; value as of Dec. 31, 1925, is $626,320×0.7903152=$194,990; value as of July 1, 1925, is $494,990×0.9803920	485,280
Total	1,378,790

36. Excess of amortization payable over amortization receivable:

Assumption A	$852,270
Assumption B	494,810

37. Excess of items payable over items receivable:

Assumption A:	
Interest	$31,488,840
Amortization	352,270
Total	31,841,110
Assumption B:	
Interest	30,792,340
Amortization	494,810
Total	31,287,150

V. VALUE AT END OF LEASE PERIOD, JULY 1, 2025, OF EXCESS INTEREST AND AMORTIZATION PAYABLE BY UNITED STATES.

38. Assumption A:

Interest payable:	
Value as of July 1, 1925, of interest during construction on Dam No. 2, $6,344,700; value as of July 1, 2025=$6,344,700×50.50449	$320,436,000
Value as of July 1, 2025, of 199 interest payments of $835,213.80, made semiannually, beginning July 1, 1926, and ending July 1, 2025, is $835,213.80×2,522.822 [1]	2,107,096,000
Value as of July 1, 1925, of interest during construction on Dam No. 3, $1,674,090; value as of July 1, 2025=$1,674,090×50.50449	84,549,000
Value as of July 1, 2025, of 193 interest payments of $546,620, made semiannually, beginning July 1, 1928, and ending July 1, 2025, is $546,620×2,234.592 [1]	1,221,473,000
Value as of July 1, 2025, of 6 semiannual payments of $546,620, beginning Dec. 31, 2025, is $546,620×5.6014317	3,062,000
Total value of interest payable	3,736,616,000

39. Interest receivable:

Value as of July 1, 1925, of 6 interest payments of $200,000 each on account of Dam No. 2, $1,048,430; value as of July 1, 2025, is $1,048,430×50.50449=	$52,950,000
Value as of July 1, 2025, of 94 payments of $1,000,000 per annum is 1,000,000×972.8612=	972,861,000

[1] For formula see page 5.

$$199\times\log(1.02)=199\times0.0086002=1.7114398$$
for which corresponding number is 51.45644

$$\text{Amount of \$1}=\frac{51.45644-1}{0.02}=\$2,522.822$$

$$193\times\log(1.02)=193\times0.0086002=1.6598386$$
for which corresponding number is 45.69183

$$\text{Amount of \$1}=\frac{45.69183-1}{0.02}=\$2,234.592$$

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Value as of July 1, 1925, of 3 interest payments of $160,000 each on account of Dam No. 3, $394,730; value as of July 1, 2025, is $394,730×50.50449=	$19,936,000
Value as of July 1, 2025, of 94 payments of $1,000,000 per annum is $1,000,000×972.8612=	972,861,000
Value as of July 1, 2025, of 3 annual payments of $1,000,000, beginning July 1, 2026, is $1,000,000×2.7750910=	2,775,000
Total value of interest receivable	2,021,383,000
Excess value of interest payable	1,715,233,000
Assumption B:	
Interest payable—	
Value as of July 1, 2025, of 199 interest payments of $954,483 made semiannually on account of Dam No. 2, beginning July 1, 1926, and ending July 1, 2025, is $954,483×2522.822=	2,407,991,000
Value, similarly, account Dam No. 3 of 193 payments of $583,814.80, beginning July 1, 1928, and ending July 1, 2025, $583,814.80×2234.592=	1,304,588,000
Value as of July 1, 2025, of 6 semiannual payments of same amount beginning Dec. 31, 2025, is $583,814.80 times 5.6014317 equal	3,270,000
Total value of interest payable	3,715,849,000
Total value of interest receivable	2,021,383,000
Excess value of interest payable	1,694,466,000

VI. ON ASSUMPTION THAT UNITED STATES FROM JULY 1, 1925 (ESTIMATED DATE OF COMPLETION OF DAM NO. 2), UNTIL EXPIRATION OF LEASE PERIOD PAYS INTEREST AT AVERAGE RATE OF 3 PER CENT PER ANNUM, THE FOLLOWING CHANGES WOULD BE MADE IN PRECEDING PARAGRAPHS.

5a. Interest payable, Dam No. 2:	
A. 99½ years at 3 per cent on $41,760,690	$124,655,660
Interest prior to Dec. 31, 1925	5,963,460
Total	130,619,120
B. 99½ years at 3 per cent on $47,724,150	142,456,880
6a. Excess of interest payable on interest receivable, Dam No. 2:	
A. Total excess	35,419,120
B. Total excess	47,256,880
11a. Excess of items payable over items receivable, Dam No. 2:	
A. Total excess	35,572,160
B. Total excess	47,965,080
15a. Interest payable, Dam No. 3:	
A. 99½ years at 3 per cent on $27,331,000	81,583,040
Interest prior to Dec. 21, 1928	1,859,740
Total	83,442,780
B. 99½ years at 3 per cent on $29,190,740	87,134,360
16a. Excess of interest payable over interest receivable, Dam No. 3:	
A. Total excess	−14,037,220
B. Total excess	−10,345,640
17a. Excess of items payable over items receivable, Dam No. 3:	
A. Total excess	−12,391,910
B. Total excess	−8,542,220
24a. Interest payable, both dams:	
A. Total interest	214,061,900
B. Total interest	229,591,240
25a. Excess of interest payable over interest receivable, both dams:	
A. Net excess (or average of $213,820 per annum)	21,381,900
B. Net excess (or average of $369,110 per annum)	36,911,240
29a. Excess of items payable over items receivable, both dams:	
A. Net excess (or average of $231,800 per annum)	23,180,250
B. Net excess (or average of $394,230 per annum)	39,422,860

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32a. Interest payable, both dams:	
A. Dam No. 2—	
Interest during construction	$6,344,700
Semiannual interest of $626,410.35×49.028305×0.9803920	30,109,640
Dam No. 3—	
Interest during construction	1,674,090
Semiannual interest of $409,965×49.028305×0.8889964×0.9803920	17,518.360
Total	55,646,790
B. Dam No. 2 semiannual interest of $715,862.25×49.028305×0.9803920	34,409.320
Dam No. 3, semiannual interest of $437,861.10×49.028305×0.9803920×0.8889964	18,710.400
	53,119,720
33a. Excess value of interest payable over interest receivable, both dams:	
A. Net excess	15,612,840
B. Net excess	13,085,770
37a. Excess value of items payable over items receivable, both dams:	
A. Total excess	15,965,110
B. Total excess	13,580.110
5b. 39a. Assumption A:	
Interest payable—	
Dam No. 2—	
During construction	320,436.000
Value as of July 1, 2025 of 199 interest payments of $626,410.25; $626,410.35×2,522.822	1,580,322,000
Dam No. 3—	
During construction	84,549.000
Value as of July 1, 2025 of 193 interest payments of $409,965 $409,965×264,592	916,104.000
Value as of July 1, 2025 of 6 semiannual payments of same $409,965×5.6014317	2,296.000
Total value of interest payable	2,903,707,000
Total value of interest receivable	2,021,383,000
Excess value of interest payable	882,324,000
Assumption B:	
Interest payable—	
Dam No. 2—	
Value as of July 1, 2025 of 199 semiannual payments of $715,862.25=same×2,522.822	1,805,993,000
Dam No. 3—	
Value as of July 1, 2025 of 193 semiannual payments of $437,861.10=same×2,234.592	978,441,000
Value as of July 1, 2025 of 6 semiannual payments of $437,861.10=$437,861.10×5.6014317	2,453,000
Total of interest payable	2,786,887,000
Total of interest receivable	2,021,383,000
Excess value of interest payable	765,504.000

(Whereupon, at 1.30 o'clock p. m., the committee adjourned until Monday, May 15, 1922, at 2 o'clock p. m.)

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MUSCLE SHOALS.

MONDAY, MAY 15, 1922.

UNITED STATES SENATE,
COMMITTEE ON AGRICULTURE AND FORESTRY,
Washington, D. C.

The committee met, pursuant to adjournment, at 2 o'clock p. m., in room 224, Senate Office Building, Senator George W. Norris (chairman), presiding.

Present: Senators Norris (chairman), Keyes, Norbeck, Kendrick, and Heflin.

STATEMENT OF MR. L. STERN, CONSULTING ENGINEER, BALTIMORE, MD.

The CHAIRMAN. Mr. Stern, we have a proposition that you have sent to the committee, and we have sent for you in order to have you explain it to us, or say anything in regard to it that you desire to.

Mr. STERN. Well, the motive which actuated me in sending in this proposition was simply that I was really indignant at some of the clauses of the proposals I have seen. I come to Washington frequently, being engaged in furnishing supplies to the Government; while going to Baltimore, I saw one of the proposals that had been made, I considered it outrageous and decided to send a proposal of my own, for the reason that I believed the water powers of the country should be reserved for the use of the people

The CHAIRMAN. What proposition was it that you saw?

Mr. STERN. I think it was tying up——

The CHAIRMAN. No; whose, I mean?

Mr. STERN. I think there were a number of them that I saw in the paper; one of them would tie up the rights to the power for a hundred years, I believe, with an option for an indefinite period after that, or something of that kind.

Senator KEYES. You don't recall whose proposition it was?

The CHAIRMAN. That was Mr. Ford's, I guess. That is the only one that puts the hundred-year limitation on.

Mr. STERN. There were a number of other clauses, and they all seemed to be just about the same, that the Government bear nearly all of the expense and the lessee obtain nearly all of the profit. So, then, I was actuated, not so much by monetary reasons as by the reasons which I have stated.

I suppose I should state my own experience. I was raised in Baltimore; went to the public schools there and graduated from the college, and from Johns Hopkins University. I have been engaged in electrical work, and afterwards in mining and chemical work, and also in furnishing supplies to the Government. I based my proposal on the proposal of which I had a rough outline, including such parts as I thought would meet with the approval of the Government. I think it was the Ford proposal that required 8 per cent profit on the manufacture of fertilizer. So I did not see why, considering that the Government owned the power and Government equipment was being used to produce the fertilizer, any profit should be made on that fertilizer, except perhaps what came from the charge for the power, which would be small. Anyway, 8 per cent profit seems to be a rather indefinite proposition. It is a matter largely of bookkeeping, as to what the 8 per cent profit would be. I think the farmer should be helped in every way possible. I don't know how this 110,000 tons of fertilizer mentioned was arrived at, but I suppose it fits in in some way with the military requirements of the War Department——

Senator KEYES. Have you ever visited this property at Muscle Shoals?

Mr. STERN. No, sir; I have never visited the property. It has really been over 20 years since I have been South. I have been located in the North.

As I stated, I think the farmer should be helped in every way. He is in a very peculiar situation. He is the pawn of the natural elements, and the prey of the unnatural ones, and anything that can be done to help the farmer should be done; when help to the farmer fits in with the military requirements of the Government it is not a matter of socialism, but it is a matter of highest patriotism.

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Hence I propose that the 110,000 tons of fertilizer material which is to be made into usable fertilizer products should be furnished free; I think this would not interfere with the regular production of fertilizer by the manufacturers, because the quantity is not sufficiently large.

Then, secondly, a considerable sum of money spent here has been by the Government. I think the money expended should be repaid to the Government on some reasonable basis; that is, not the entire amount expended, because a large part of it was spent under the emergency of war conditions and does not represent present value, but such of it as represents present value should be repaid the Government at a certain rate—as I state here, at the rate of 2 per cent per annum, but any other rate that is reasonable would suit.

Besides, there was a clause in Mr. Ford's proposition, I think, to pay $55,000 annually for maintenance of navigation. There is no reason why whoever has the power should not pay for the operation of the locks.

As I say, I was not actuated by mercenary motives. If I could prevent this plant from falling into the hands of a monopoly, or an individual corporation that would use it largely for its own profit, and could make a profit besides, I would be perfectly satisfied, and therefore I inserted that if there is any profit I would repay 60 per cent of it to the Government.

So that covers these clauses mentioned here. There is one other. The first one is the plant is to be completed under our supervision at Government cost. I think the plans all call for that, namely, that the Government complete the plant and pay for the work, and I just say 4 per cent interest should be allowed the Government on the amount expended, which should be charged as part of the expenses of the plant in calculating earnings.

This proposal is only a rough outline. Any kind of reasonable proposal would suit me that would give me a chance. I am not a millionaire, and I don't desire to make millions, and would not know what to do with them if I had them. So I have just presented a rough outline to you gentlemen.

I suppose the next thing is what I would do in case I should obtain the lease. First of all I intend to make fertilizer, 110,000 tons. That will probably be made largely during what you might call the off hours of the plant, using surplus power as far as possible. This power would probably take care of this 110,000 tons.

The CHAIRMAN. Do you mean by that secondary power?

Mr. STERN. Not necessarily.

The CHAIRMAN. Suppose you did have sale for all the power there, then what about fertilizer?

Mr. STERN. It would not matter. In the first place, the fertilizer is an essential part of the proposition; 110,000 tons of ferrilizer must be furnished regardless of whether there is a demand for the power to be used for other purposes or not.

The CHAIRMAN. You speak in your bid of fertilizer?

Mr. STERN. Yes, sir.

The CHAIRMAN. One hundred and ten thousand tons of fertilizer. Now, 110,000 tons mentioned in Mr. Ford's bid is not fertilizer, but just one of the ingredients of fertilizer. It would make a great deal more fertilizer than that.

Mr. STERN. Yes. That is perfectly true. He proposes to furnish ammonium nitrate.

The CHAIRMAN. Is that what you mean when you say fertilizer?

Mr. STERN. Yes, sir; that is what I mean exactly. Then I think he proposes to convert that into fertilizer.

The CHAIRMAN. That is, as I understand it, the capacity of what is known as nitrate plant No. 2. One hundred and ten thousand tons is the capacity of that plant in ammonium nitrate, which is the same, as I understand, as 40,000 tons of nitrogen. That would make several million tons of completed fertilizer.

Mr. STERN. Yes, sir. I think the usual mixture is about two parts of nitrate, eight parts of phosphoric acid, and two parts of potash.

The CHAIRMAN. What I want to get clear is whether when you speak in your offer of 110,000 tons of fertilizer you mean 110,000 tons of ammonium nitrate.

Mr. STERN. Not necessarily ammonium nitrate; but I mean fertilizer material corresponding to ammonium nitrate. That product should be made which could be made to the best advantage.

The CHAIRMAN. That plant is specifically designed and equipped to get nitrogen out of the air.

Mr. STERN. Yes, sir. Ammonium nitrate, if that is the best product to produce, or some other product if ammonium nitrate is not the best; but what power is required to produce that 110,000 tons should be used. It just depends on what method you use.

The CHAIRMAN. You would expect to use enough power to produce that?

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Mr. STERN. Yes, sir.

The CHAIRMAN. And sell the balance?

Mr. STERN. Not only that. I don't know how the 110,000 tons of ammonium nitrate was arrived at. Is that arrived at in conjunction with the War Department to meet military requirements?

The CHAIRMAN. Yes. That is all they could make out of it.

Mr. STERN. If it is not, the quantity should be changed to do that; but I think the first thing, one of the first essentials of this plant, should be to provide the Government with nitrate for military purposes, as there are no nitrates in this country.

The CHAIRMAN. In your bid here you use the word "we." What do you mean by that?

Mr. STERN. That is just an editorial expression. I come here representing no one except myself. I have no entaglements with anybody.

The CHAIRMAN. Suppose Congress accepted your bid. Would you expect to organize a company or corporation, or would you do it individually?

Mr. STERN. I would probably organize a corporation with a small amount of capital, which I would control myself, but would let the corporation enter into an agreement with the Government on such terms as would be proper.

The CHAIRMAN. Would you be able to organize a corporation with a paid-up capital of, say, $10,000,000?

Mr. STERN. Yes, sir; or a hundred million, if you wish; but my idea is to organize a corporation with a capital of $20,000, or thereabouts, for the purpose of operating in corporate form rather than individually.

The CHAIRMAN. You would accept it either on a 25-year or a 50-year basis?

Mr. STERN. Yes, sir; just because I am actuated by the motives I said. I think it should be for not less than 25 years, because it will probably be necessary to make contracts for power for 25 years.

The CHAIRMAN. Would you be willing to enter into a proposition whereby you would be required to put up a bond to comply with your part of the contract?

Mr. STERN. Yes.

The CHAIRMAN. Would it be material to you what the amount of that bond was?

Mr. STERN. No.

The CHAIRMAN. Have you made any arrangements for financial assistance in the event this is given to you? How do you know that you can carry through the financial part?

Mr. STERN. I know I can carry through the financial part. I have made no arrangements with anyone. I came here entirely unentangled. I am acquainted with people having large financial resources, and I am acquainted with large industrial corporations.

The CHAIRMAN. Have you means of your own to carry it out?

Mr. STERN. To do what I propose to do; yes, sir. To furnish millions, I have not. I don't think it is necessary.

The CHAIRMAN. Well, you understand if the Government accepted your bid you would enter into a contract by which you would agree to take charge of the construction, for instance, of the dams down there.

Mr. STERN. Yes, sir.

The CHAIRMAN. Have you had experience in that line?

Mr. STERN. Yes, sir.

The CHAIRMAN. Where?

Mr. STERN. In the North. I have done all kinds of building. I used to secure water powers.

The CHAIRMAN. What great water power project have you had charge of?

Mr. STERN. None. I have owned part of water powers in the North, but I had nothing to do with the actual building of the projects.

The CHAIRMAN. Your letterhead describes you as a consulting engineer. What experience have you had as an engineer?

Mr. STERN. I have always been acting on my own account. I have never had a job in my life with anyone. Whatever I have done I have always done on my own account.

The CHAIRMAN. Acting on your own account, what projects have you constructed or had under your charge when they were constructed?

Mr. STERN. I have erected buildings. I have owned a water power.

The CHAIRMAN. Where?

Mr. STERN. In Ontario.

The CHAIRMAN. Did you construct it?

Mr. STERN. No, sir.

The CHAIRMAN. How big a one was it?

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Mr. STERN. It is a very large one, but it was sold. I sold it, and I didn't pay any attention to it afterwards.

The CHAIRMAN. You have not had any experience in construction of dams, have you, on large scales?

Mr. STERN. No; but I have been living on them for 10 years or more. I know all about them. I was not actuated by any desire to make money, and I never engaged in anything of that kind. I have bought them and sold them and made a business of it. I have been interested in my own chemical work for years.

The CHAIRMAN. I suggest, Mr. Stern, that you insert in the record a copy of your bid. This is a letter directed to me as chairman of the committee. I have your original letter here, and I judge you have a copy there in your hand.

Mr. STERN. Yes, sir.

The CHAIRMAN. Have you another copy?

Mr. STERN. No, sir.

The CHAIRMAN. Maybe I had better read it.

Mr. STERN. I can pass this around.

The CHAIRMAN. It will take less time to read it.

(The chairman read the proposal referred to as follows:

[Manufacturer of chemical and industrial products. L. Stern, consulting engineer. Chemicals, oils, mineral products.]

BALTIMORE, *May 12, 1922.*

DEAR SIR: We herewith propose to lease from the Government the Muscle Shoals power project for a term of 25 or 50 years or such other time as may be agreeable on the following conditions:

1. The plants to be completed under our supervision at Government cost; 4 per cent interest annually to be allowed the Government on amount necessary for completion.

2. A valuation to be placed on the work already done based on what would have been the average cost during the period from 1904 to 1914, and this sum to be repaid the Government at the rate of 2 per cent per annum, besides $55,000 annually for maintenance of navigation locks.

3. The power obtained to be used in the manufacture of fertilizers to such an extent as may be feasible and in the manufacture of electro metallurgical products: 110,000 tons fertilizers to be sold at cost of production; in case of war plants to be immediately converted for manufacturing war materials which shall be sold to the Government at prevailing prices; any surplus power to be sold direct to users or to power distributing companies.

4. In addition to the above-named payments, 60 per cent of all net profits derived from the operation of the plants to be paid to the Government, and 40 per cent to us.

The above is only a rough outline in general terms of what we propose.

Our proposal allows the Government for all monies expended, gives the farmers 110,000 tons fertilizers at cost, and gives to the Government a large percentage of all profits derived, with the benefit of private operation.

If you wish to see us in regard to the matter we would be pleased to call.

Yours truly,

The CHAIRMAN. You have not seen these dams, have you?

Mr. STERN. No, sir; I have not. First of all, I desired to find out exactly what the committee wants; secondly, if I saw the plans, etc., it probably is not necessary for me to see the dams, as I am familiar with this kind of work. At present I have only a rough outline of the plans.

The CHAIRMAN. Do any other members of the committee want to ask the witness any questions?

Senator KEYES. Mr. Stern, what about this Ontario property. Can you not give us some idea as to how much of a proposition that was, how large a water power it was, and what has been done with it?

Mr. STERN. Yes sir. That has been developed. I left there shortly afterwards I really had a half interest in it, and it was the other man who sold it to the power company.

The CHAIRMAN. How long ago was this?

Mr. STERN. Well, before the war. In 1912, I think.

Senator KEYES. Whereabouts in Ontario was it?

Mr. STERN. In northern Ontario, in the cobalt region. I lived there for two years. I lived around Montreal for ten years.

Senator KEYES. Was that a 50-horsepower?

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Mr. STERN. Oh, yes, it was larger than that. It was a large water power.
Senator KEYES. How large?
Mr. STERN. That I can not say. Probably 50,000; 50,000 to 100,000.
Senator. KEYES. What stream was it on?
Mr. STERN. The Montreal River, a very powerful stream.
Senator KEYES. How big a dam was it?
Mr. STERN. Not such a big dam; probably 200 feet.
Senator KEYES. How high was the dam?
Mr. STERN. I don't remember what fall.
Mr. KEYES. Have you seen the dam?
Mr. STERN. No sir, I haven't seen the dam. It was finished after I left. I got rid of it at that time and I can not give you the details of it. I am familiar with the water powers, though, in Canada. I lived there for 10 years.
Senator KEYES. What other water powers are you familiar with?
Mr. STERN. I know Niagara, and I know the falls around Montreal. I lived at Montreal for 10 years. I have been at the falls of Three Rivers, and I have been at Montmorency, I was interested in buying water powers at one time, and I kept track of what was going on throughout northern Ontario. I am familiar with the water powers of north Ontario which a lot of people don't know anything about, on rivers which flow into Hudson Bay.
There is this further consideration. This is a big scheme but most people are attracted only by its magnitude, while they do not comprehend what an exceedingly important matter it is in our water power development.
During the past generation industrial supremacy has been with the nations that possessed black coal; during the coming generations it will be with those who have white coal, and here in the States you will be compelled to compete with Canadian water powers.
Most of us are familiar with the water powers that empty into the St. Lawrence. You know Niagara. You know Montmorency, and you know Three Rivers, but most people are not acquainted with the tremendous water powers in the Province of Quebec, within 75 miles of the United States border line, where there is one of over 500,000 horsepower.
Senator KEYES. What one is that?
Mr. STERN. I don't even recall the name. I think it is on the Bersimis River, is it not?
Senator KEYES. I don't know. I was asking you.
Mr. STERN. I don't recall the names. They are Indian names and hard to remember. For instance, in northern Ontario, flowing into Hudson Bay there are a number of powerful rivers. One has been developed with an original horsepower of 45,000. I believe that has been increased since to 100,000 horsepower.
It is necessary, in order to compete with other nations, that the water powers of the United States be developed as economically as possible, that they be not saddled with large issue of bonds, etc., thus preventing the country from getting the benefit of cheap power.
Even this last week private interests have secured control of the water power on the Susquehanna River, and application has been made to the Public Service Commission of Maryland to issue $20,000,000 of bonds to cover cost of development. The engineer of the commission estimates the cost of development will not be over $7,000,000. That means they wish to issue $20,000,000 worth of bonds to cover $7,000,000 of cost, and the people will pay interest on those $20,000,000 indefinitely. Not only that, when they come to make the rates, being allowed to earn 6 per cent they will not as 6 per cent on the bond issue; they will consider the bond issue as part of the capital cost and they will ask interest on the stock which they probably will issue and sell all over the country, and thus obtain thousands of supporters who will help them to get a rate which will give them interest on all that stock.
Senator KEYES. As I understand you, you feel that a capital of $10,000 would be adequate to go on with this proposition?
Mr. STERN. No, sir, I don't. It would take more than that to carry on this project. I think a capital of $10,000 will be adequate for purposes of incorporation.
The CHAIRMAN. You are going on the theory that the Government puts up the money?
Mr. STERN. Yes, sir; the Government puts up the money for completing the plant.
The CHAIRMAN. Yes.
Mr. STERN. Yes, sir.
The CHAIRMAN. So that it would not need any great expenditure of money?
Mr. STERN. Considerable money will be needed. I have not told you what I had in mind when I made this proposal. First of all, there were to be manufactured

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110,000 tons of fertilizer material, or whatever quantity should be required to meet the military necessities of the United States. That gives the United States an operating arsenal without expense to the United States and which will pay its own maintenance costs.

Secondly, I intend to put cheap power in every farmhouse within 150 miles of Muscle Shoals; not only for the purposes of household uses, but for running light machinery and for general agricultural purposes.

In northern Europe, Norway and Sweden and some of the other countries, they are developing their powers, not for electrical power purposes but for agricultural purposes. It was found by subjecting crops to electrical treatment—and it has been practically developed—you can take hay, corn, cotton, and double their production by subjecting them to electrical treatment, and there is no reason why this should not be done in the United States.

The CHAIRMAN. Is that being done anywhere?

Mr. STERN. Yes, sir; it is being done to-day.

The CHAIRMAN. In Norway?

Mr. STERN. Yes, sir; and I think in Sweden and Switzerland.

The CHAIRMAN. How do they apply the electricity?

Mr. STERN. In northern countries like Norway and Sweden, there is in the fall of the year considerable fall of moisture and the crops often rot before they can be gathered To prevent this loss the crops are treated electrically. The arrangement is very simple. The farm products are placed between two metal plates to which wires are attached, by means of which an electric current is passed through them. The exact action is not understood, but it is believed that the current kills the bacteria. Anyway, it has been found over an experiment of two years, that the crops can be easily doubled. Not only that, the farmers can be assured of their crops.

Thirdly, I had in view an industrial development to use whatever power was available; for building up a large general industrial community and not have the power tied to one interest which, when times are dull, might be affected adversely and perhaps be under the necessity of closing down.

The CHAIRMAN. Do you expect to build the industries or sell the power to somebody else?

Mr. STERN. No, sir; I expect to allow these industries to build themselves and buy the power.

The CHAIRMAN. The profit you expected to make out of it was by the sale of the power?

Mr. STERN. By the sale of the power; perhaps also manufacturing myself. But that was not part of my plan. I think every ampere of power than can be generated there can be disposed of immediately.

Senator KEYES. Have you had experience in manufacturing industries of any kind?

Mr. STERN. Yes, sir; I am a manufacturer.

Senator KEYES. Of what?

Mr. STERN. Chemicals; and I make Government supplies. I make mail bags for the Post Office Department.

Senator KEYES. Mail bags?

Mr. STERN. Just now, yes, sir; and I furnish coal and oil to different departments.

Senator KEYES. Where is your factory where you make mail bags?

Mr. STERN. In Baltimore.

Senator KEYES. How large a factory is it?

Mr. STERN. It is small. I employ about 30 men. It all depends on the orders I get.

The CHAIRMAN. Where do you supply coal and oil now?

Mr. STERN. I came over here this morning and offered to furnish coal to the Public Health Service.

The CHAIRMAN. Where do you get your coal? Do you mine it? Have you a coal mine?

Mr. STERN. No, sir; I have no coal mine. I buy from coal operators. I get coal from various sources—from Kentucky and from Tennessee, around Coalville, and from Pennsylvania. The same with oil. I buy oil.

Senator HEFLIN. Mr. Stern, are you interested in any power concern in the United States?

Mr. STERN. No, sir; I have no connection with any power concern in the United States.

Senator HEFLIN. Or any fertilizer manufacturer?

Mr. STERN. No, sir; and no banking interests. I came here on my own responsibility. I have done business with them, but I came here absolutely free and absolutely untangled, exactly as I have stated. I have approached nobody and have

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spoken to nobody. Newspaper people have been pressing me and I have refused to give them any information.

Senator HEFLIN. You would just like to have Muscle Shoals, though?

Mr. STERN. I would like to have it on any reasonable terms, and I leave it to you gentlemen to say what are reasonable terms. My terms are not like the laws of the Medes and Persians, nor like the fourteen points. You can change them any way, so long as you do it in a reasonable manner.

Senator HEFLIN. Any way we think it will be satisfactory to you?

Mr. STERN. What is that?

Senator HEFLIN. Whatever we do to them they are satisfactory to you?

Mr. STERN. Not necessarily. I suppose you, as reasonable men, will be just to me and just to the Government.

Senator HEFLIN. Mr. Ford has got a pretty good offer in there, hasn't he?

Mr. STERN. I don't see that he has any better than anybody else. I did not come here to attack anybody. I was not sent here to attack anybody. I came here simply actuated by the motives which I have stated.

The CHAIRMAN. All right, if that is all.

Mr. STERN. If there is anything else you would like to ask me, I would be glad to answer, if I can.

STATEMENT OF MR. CHARLES H. MacDOWELL.

Mr. MACDOWELL. My name is Charles H. MacDowell. I am president of the National Fertilizer Association and president of the Armour Fertilizer Works. During the war I was director of the Chemicals Division of the War Industries Board and personally handled the problem of our nitrate supply. I was also technical economic adviser to the Peace Commission in Paris. I am president of the Western Society of Engineers and a member of the Federated Engineering Council of Washington.

I mention these activities to indicate that I have had opportunity to become familiar with the national needs for nitrogen.

The CHAIRMAN. Are you a chemist, Mr. MacDowell?

Mr. MACDOWELL. No, I am not a chemist nor am I an engineer, but I have received the honorary degree of doctor of science from the University of Pittsburgh for accomplishments in industrial chemistry, and I am on the committee on chemistry of the board of overseers of Harvard University.

The CHAIRMAN. How long have you been connected with the fertilizer industry?

Mr. MACDOWELL. I started the fertilizer by-product department of Armour & Co. in 1894. It has been my work to develop some of the by-product savings in the packing industry, and that branch gradually has expanded into a large fertilizer and general chemical industry.

The CHAIRMAN. Were you engaged in the fertilizer industry prior to that?

Mr. MACDOWELL. No; I entered the service of Armour & Co. as a young man. I came from down State in Illinois. I became interested in fertilizer, and Mr. Armour, sr., put me at that work, so all my business life has been in the development of that industry, saving the waste products of the packing house.

The CHAIRMAN. You say you are president of an organization of fertilizer people?

Mr. MACDOWELL. Yes, sir.

The CHAIRMAN. What is the organization?

Mr. MACDOWELL. The National Fertilizer Association is an organization composed of nearly all the fertilizer manufacturers of the United States, both North and South, including Hawaii.

The CHAIRMAN. What is the object of that organization?

Mr. MACDOWELL. The association is what we call a service organization. It maintains an educational bureau for the dissemination of information that the various State chemists and agricultural experiment station workers develop; for educating our own members as to the educational and practical side of fertilizers and their use; to meet with the various educators in formulating better ways of manufacturing and selling fertilizers; and engaging in all of these service activities which will help the farmer and which naturally will help us in carrying on our business to better advantage and making it a higher grade and more efficient industry.

The CHAIRMAN. How many organizations, corporations, and partnerships, etc., are there in your national association?

Mr. MACDOWELL. I do not recall exactly, but I think there are about 150 manufacturers of complete fertilizers, and probably as many more, or nearly as many more, companies that manufacture fertilizer materials or machinery or those things which tie into the general industry.

The CHAIRMAN. How often does that association meet?

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Mr. MACDOWELL. The association has one meeting each year, an annual convention, and it has an executive committee which meets generally twice a year, once at the convention and once during the interim.

The CHAIRMAN. You have some salaried officials, do you?

Mr. MACDOWELL. We have a secretary in Philadelphia and also Mr. Tierney, who is here maintaining our Washington office. The association also looks after the railroad and power needs of the members; it has an insurance bureau working on insurance methods and——

The CHAIRMAN (interposing). It is a sort of clearing house, as I take it.

Mr. MACDOWELL. Well, it is a service or helpful association. It has nothing whatever to do with prices or with those trade questions which a good many associations attempt to handle more or less.

The CHAIRMAN. The persons or corporations who compose this association are all competitors, are they?

Mr. MACDOWELL. Yes, sir.

The CHAIRMAN. What information does that association convey to its members? What kind of information? What is the service it renders?

Mr. MACDOWELL. Well, it gives them information, for instance, on insurance matters. It gives them information with regard to the proper use of fertilizers, the manufacturing of them, and general matters of that sort.

The CHAIRMAN. Well, now, if you, as president of the Armour Fertilizer Works—and I suppose that is one of the members of the national association?

Mr. MACDOWELL. Yes, sir.

The CHAIRMAN. Now, as president of that organization if you should discover some new method of manufacturing fertilizer or cheapening your method of doing it, would you communicate that to the other members of the national association?

Mr. MACDOWELL. No; not necessarily; we might. I, myself, have always gone on the theory of helping our competitors and helping the industry as much as we could. If there are new developments or new processes which come up, I tell them of it, so far as my own personal attitude is concerned, but the association itself maintains no research facilities. If any research work is done it is done by the different members of the association at their own expense. I mean technical research.

The CHAIRMAN. That is what I was getting at.

Mr. MACDOWELL. It is a service association.

The CHAIRMAN. When you obtain any information of that kind you tell the other members what it is?

Mr. MACDOWELL. Yes; although that is not a part of the purpose of the association. We might or we might not. But anything of general interest we would advise them.

The CHAIRMAN. Is that usual with people engaged in a competitive business, that they convey to their competitors any improved methods that they discover?

Mr. MCDOWELL. We would not convey to them any secret methods, for instance, which we discovered. We would not do that. But there are virtually no secrets in the fertilizer industry. If there should be some published developments which are of interest to all—and some of our members are not technical and do not know about them—we might tell them of that. But we do not aim to do anything of that kind. That is not a part of the association's work.

The CHAIRMAN. Has there been competition in the fertilizer business?

Mr. MACDOWELL. Extreme and unlimited.

The CHAIRMAN. Did that bring about any feeling of any kind between the members of this association?

Mr. MACDOWELL. Yes, natural feeling that competitiors have in business.

The CHAIRMAN. When you meet annually, or when the executive committee meets, at the meetings do they have a controversy?

Mr. MACDOWELL. Nothing special, because we have always kept away from those trade questions.

The CHAIRMAN. What does the association do? What does this committee do?

Mr. MACDOWELL. As I told you, they spend quite a little money in this educational work. We maintain these other bureaus and study methods of analyzing fertilizers, working with the official agricultural chemists and developing better methods of analysis, and so on.

The CHAIRMAN. It is for the benefit of the whole trade?

Mr. MACDOWELL. That is for the benefit of the trade; yes, sir.

The CHAIRMAN. Do you convey that information to the fertilizer people who are not members of your association?

Mr. MACDOWELL. Practically all of the results are published in the American ertilizer and the Southern Commercial Fertilizer, and all members of the industry t the information, whether they belong or not.

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The CHAIRMAN. You say practically. That modifies it somewhat. How near does that mean to all?

Mr. MACDOWELL. We do not publish our minutes, but we publish our general proceedings. All of our convention proceedings are published.

The CHAIRMAN. But what I am trying to get at is if you discover something to help the fertilizer business and you communicate it to those other members, would it likewise be communicated to fertilizer people who were not members?

Mr. MACDOWELL. Why, I fancy so. But if we ourselves discovered anything that was of great importance to ourselves, I don't know that we would publish it. We are no different from any other manufacturing concern. But what I do mean is that we have not tried to be secretive. There is more or less secrecy in all business—most of it unnecessary, as a matter of fact. We have not tried to be especially secretive, but if we develop anything new we patent it, and if it is useful we make use of it. We are not giving everything away. I don't mean to convey that idea. But in the development of better uses for fertilizer materials and things of that sort we give out some of that information or not, just depending on how we feel about it.

The fertilizer association is and always has been largely a social organization, making much of the social features of the annual convention. We also give service to our members, which has distinct value, in advising them of better methods in the preparation of fertilizer. The association maintains fellowships in some of the colleges to study how fertilizer can best be applied, what kind of machinery is best suited for its application, how near the roots it should go, whether under or above or both, and all that. When these fellowships conclude their work the results are all given to the public, and that includes manufacturers of fertilizer distributing machinery and all those to whom the knowledge has special interest.

Senator KEYES. What proportion of the fertilizer output is represented in your association?

Mr. MACDOWELL. I would say probably of the manufacturers of fertilizers about 90 per cent. It is quite representative of the industry as a whole.

The CHAIRMAN. Now, go on in your own way, Mr. MacDowell.

Mr. MACDOWELL. The fertilizer industry has, as I recall, about 600 plants. Those plants vary in size from 5,000 tons capacity a year to say 200,000-tons capacity a year.

Senator NORBECK. May I ask one other question? You put out a complete fertilizer, do you?

Mr. MACDOWELL. We put out anything the farmer wants; complete fertilizer, fertilizer materials, acid phosphate, whatever he needs. The part of the business that is done as complete fertilizer is the larger part.

Senator NORBECK. What per cent of the business does Armour & Co. do?

Mr. MACDOWELL. The Armour interests I would say, do about 8 per cent of the United States fertilizer business.

Senator NORBECK. Eight per cent?

Mr. MACDOWELL. Yes, sir.

Fertilizers are made in manufacturing plants during all the year. The fertilizer industry is the largest of the heavy chemical group, and ordinarly makes or buys about two and a half million tons of sulphuric acid. Fertilizer manufacturers buy or mine phosphate rock, grind it and make acid phosphate, which is the basis of the fertilizer used in the country. That ingredient is lacking in most of our soils, perhaps to a greater degree than any other of the essential ingredients. It is made every day, cured and put in good mechanical shape. Where complete fertilizers are made, the nitrogen and potash are combined with acid phosphate, stored, cured, and at the time of shipment packed in bags and shipped out in cars either as straight or mixed brands. The business is shipped out in the spring in approximately 90 days. In the fall the shipping period is a little over two months.

The plan on which the business has been developed is to send the concentrated materials such as rock, sulphur, ammonia, and potash, to plants averaging perhaps 25,000 or 30,000 tons capacity, and shipping the completed product out within a few miles of the plant. Broadly speaking, the industry produces very little nitrogen itself. That material is bought in the market. The nitrogen that is produced is largely nitrogen converted from industrial waste, such as leather scrap, old felt hats, hair, waste and materials of that kind which are processed to make the nitrogen available.

Sugar beet slops and other industrial waste also is used. Some factories use tankage from city or packing house rendering, and in the South certain manufacturers use cotton-seed meal in their goods, especially off meal.

Packing-house materials and cotton-seed meal are going more and more into cattle feed, so that that source of supply is decreasing as far as the fertilizer industry is concerned.

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The industry gets much of its nitrogen, aside from the organic forms, in the form of nitrate of soda and sulphate of ammonia. The nitrate is imported from Chile and the sulphate of ammonia comes from the coking plants.

Prior to 1914 the United States imported ammonium sulphate, but with the increased production coming from war development there now is exported a considerable tonnage. Our agricultural interests are not taking all the ammonium sulphate now being produced here.

The CHAIRMAN. Where is it produced?

Mr. MACDOWELL. At all of the metallurgical centers and in cities where gas is made.

There is considerable misunderstanding on the part of the public as to the different forms of nitrogen used in the fertilizer industry. The production of ammonium nitrate at Muscle Shoals has given rise to the erroneous impression that this plant will make the nitrates which the farmer has been accustomed to using—that is, nitrate of soda. This plant will not make that form, and the ammonium nitrate form is not suitable for mixing or blending in fertilizers, so that there is very little outlet for it in that form for agricultural purpose.

The CHAIRMAN. Ammonium nitrate, you say, it is not practical to use in the manufacture of fertilizer?

Mr. MACDOWELL. It is hydroscopic. It draws water. It is sticky and is very concentrated, and it is quite difficult to blend it evenly through a ton of fertilizer and keep the fertilizer dry and friable so that it will drill well in the fertilizer drills through which a great deal of our fertilizer is applied.

The CHAIRMAN. Does that mean that this plant No. 2 could not be utilized, in your judgment, in the manufacturing of a fertilizer ingredient?

Mr. MACDOWELL. No; I would not say that; but they would probably have to make sulphate of ammonia, the commercial form which the fertilizer industry is accustomed to using.

The CHAIRMAN. In getting it out of the air would they get sulphate of ammonia before they got ammonium nitrate, or would it be the other way?

Mr. MACDOWELL. In the making of ammonia through the cyanamid process at Muscle Shoals, they mix lime and coke, treat it in an electric furnace and make an intermediate product known as cyanamid, which is alkaline, and which can not be used in greater amount than 50 or 60 pounds per ton of complete fertilizer. If more than this proportion is used, it being so alkaline, it causes the phosphoric acid to revert and it releases ammonia, too. In order to get this nitrogen in shape for war purposes they treat it in caustic solution in a pressure tank and decompose it and ammonia gas comes off. That ammonia gas is the same form as you get in coking coal. Nitrogen is in coal, and when coal is coked part of it comes off as ammonia gas, and is recovered. So when they produce ammonia gas they either make aqua ammonia out of it through water absorption or passing the ammonia through a bath of sulphuric acid and make sulphate of ammonia. The sulphuric acid fixes it in the form of sulphate of ammonia, the form of ammonia the fertilizer manufacturer uses, inorganic ammonia.

The CHAIRMAN. It is just as easy for that plant to make it in that form as the other, is it not?

Mr. MACDOWELL. Making it into ammonium nitrate requires an expensive plant. This plant is already built at Muscle Shoals. There is no sulphate of ammonia plant there. This would have to be constructed.

The CHAIRMAN. In your judgment in getting fertilizer down there it would not be proper to make ammonium nitrate at all?

Mr. MACDOWELL. No. My judgment is that sulphate of ammonia might be made. However phosphate rock might be volatilized and made into a solution and the ammonia fixed in that instead of in the sulphuric acid, which then would produce ammonium phosphate.

The CHAIRMAN. When they get it in the form of sulphuric acid they later have to take the sulphuric acid out?

Mr. MACDOWELL. No. When fertilizer containing sulphate is applied the sulphates are often useful themselves. Sulphate of ammonia is worked on by bacteria in the soil and the ammonia is converted into a nitrate by the bacteria, and taken up by the plants.

The CHAIRMAN. Don't you have to be careful in making fertilizer not to get too much sulphuric acid in it?

Mr. MACDOWELL. In making acid phosphate we aim to get the greatest use out of the sulphuric acid. In converting phosphate rock into water-soluble phosphoric acid—all of these products are slightly acid, but they ordinarily contain only about 1½ per cent of free acid.

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When fertilizers are applied, the soil waters dissolve the phosphoric acid and the solution impregnates the soil. The salts of the soil neutralize the acids and hold the phosphorous until the plant uses it, so that there is practically no leaching. There used to be a feeling that acid fertilizers were not good for the soils, but this opinion is changing. It is a part of good farming to keep the soil sweet by liming and cultivating.

The fertilizer industry is not opposed to the development of the Muscle Shoals water power. It believes that the development should be made along sound engineering lines and that the power, when developed, should be used for the best interests of that locality. The industry questions the public policy of turning the power and its control over to an individual for as long a period as 100 years; but if the project is developed at Government expense it does not think that it is a good thing for the locality for one man to be able to dictate what kind of an industry should be developed in that particular section. Moreover, the fertilizer industry does not favor the Government's building new plants for private individuals to use for their personal advantage to compete unfairly with industries not so fortunately subsidized.

If the Government develops this power and improved methods of making fertilizer by power are developed, which is always possible, the industry feels that such of their members as may want to use that power to make fertilizer should have equal opportunity in making use of it.

I personally suggested to Mr. Swann at Anniston that he start the experimental work he has done so well in the smelting of phosphate rock. We wanted phosphorus during the war, and he had equipment which it seemed to us might be used to make phosphorus cheaper than by building a new plant. Later we encouraged him to undertake this new work when the armistice was signed. During that period I suggested to him that he also try to make some phosphoric acid, and potash because we needed those ingredients and there were some raw materials containing some potash near there. He has done fine work. I think there is a probability of making phosphoric acid in that region by the smelting process a little cheaper than by the acid process. However, I think I can make a concentrated superphosphate in Tampa by the acid process as cheaply as it can be made at Muscle Shoals, and it is a better point for distribution. These are all new developments and should be followed up. Our own company has done a good deal of research work along those lines, trying to find cheaper and better ways of making fertilizer. But the industry does not feel that it would be good public policy to give Mr. Ford a monopoly of the power and its utilization over a long period of time. Further, it questions when there is a surplus of the particular form of nitrogen that would be made there, whether it is good business to make more of it, as we are dependent now and probably will be for some time, on foreign outlets to take care of the surplus we are now producing.

The CHAIRMAN. Your contention is we have more nitrogen now than we need?

Mr. MACDOWELL. No. My contention is that we have more nitrogen in this form than we use. I think we ought to use a good deal more than we do.

The CHAIRMAN. The only way to get a large use, then, assuming that is correct, would be to cheapen it, would it not?

Mr. MACDOWELL. Yes; but this method of Mr. Ford's will not cheapen nitrogen as compared with the coke-oven method of making it, because they get theirs for practically no cost outside of the acid, whereas Mr. Ford would have to mine a lot of lime and coal, use transportation and power, and his costs would be greater.

The CHAIRMAN. Do you buy from those people in making fertilizer?

Mr. MACDOWELL. Oh, yes.

The CHAIRMAN. What does it cost you?

Mr. MACDOWELL. The present market—I would say we have not any contract at the moment—is around $3 per hundred pounds. Six months ago it was down to $2 per hundred pounds.

The CHAIRMAN. For what?

Mr. MACDOWELL. Sulphate.

The CHAIRMAN. Sulphate of ammonia?

Mr. MACDOWELL. Yes, sir. It was selling quite freely here at $40 a ton, delivered at coast points. Recently there has been some advance, but we are over the spring season and the price will sag. It will probably land around $50 a ton.

We figure that it would cost Mr. Ford, aside from power costs, around $55 a ton to make.

The CHAIRMAN. Then he won't hurt you any?

Mr. MACDOWELL. No, he would not on that end of it. He would be merely adding to a surplus which now exists. We hope that surplus won't exist very long. The fertilizer industry wants the farmer to use nitrogen. The trouble with the fertilizer industry to-day is that it has a ten million ton manufacturing capacity and five million tons of business.

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The CHAIRMAN. Don't you think it is because it costs so much to the farmer that he does not use more?

Mr. MACDOWELL. No.

The CHAIRMAN. Why is it that he does not use more?

Mr. MACDOWELL. Because he is cutting out everything that he can avoid buying. He has been through terrible times, and is effecting every economy he can. This is one of the things that takes hard money out of his pocket, and unless he is thoroughly convinced that it will make him money, he says, "I will wait until next year." We have had a big trucking trade this year. In fact we have had as big a trade with the truck farmers along the coast and down the gulf as we ever had, and there has been quite a decided increase in the grade of fertilizer used on truck farms.

The CHAIRMAN. That is only one of the expenses that a farmer has to go to in order to produce a crop. Assuming that he does not use enough—and I presume that is a fair assumption; everybody seems to agree with that, even the farmers themselves—assuming that he does not use enough and that there is more to be had, the only reason he does not take more is because of the cost, is it not? He knows he ought to have more.

Mr. MACDOWELL. He knows he ought to have more. Fertilizers this spring, broadly speaking, have been selling below the cost of manufacture.

The CHAIRMAN. I am not speaking of that.

Mr. MACDOWELL. I know that, but those costs are practically down to pre-war costs.

The CHAIRMAN. I understand that. Just assume, for the purpose of my question, that you can not make them any cheaper; it seems to me that it gets back again to the proposition, regardless of whether there is any profit in it, and whether there is no profit or whether there is a loss, if the farmer could get fertilizer cheaper he would use more of it?

Mr. MACDOWELL. Broadly speaking, stable, reasonable prices for fertilizer develop business, and that is what the fertilizer industry wants. The fertilizer industry's best interests are not served by high prices. The fertilizer industry's best interests are served by making in volume goods and cutting their manufacturing costs down.

Senator HEFLIN. Then you agree if the price was lower the farmer would use a great deal more than he does?

Mr. MACDOWELL. That depends on whether he thought it was going lower still. In other words, we must have a stabilized price that the farmer thinks is fair, and if the farmer thinks he can afford to use the fertilizer at that price he is willing to buy. The willingness of the farmer to buy is the psychology, of course, of the consumption of fertilizers, if he thinks that they will profit him in their use. If he can be shown that, he is a willing buyer.

Many of our agricultural experts say that the farmers in the grain sections should go still further with legumes, with clover and with those plant forms of fixing nitrogen the so-called restorative crops before buying nitrogen. I think there is a good deal in it, but perhaps they are a little extreme. But that is what they are telling their people. They say the first thing to be used is phosphoric acid, because the soil is more deficient in that than in nitrogen. Then as the soil is built up in phosphoric acid, some of the restorative crops should put in and nitrogen be obtained in that way.

Senator NORBECK. Do they go so far as to say that nitrogen can be secured from the growing of certain crops, and that with careful farming there is no need to purchase nitrogen?

Mr. MACDOWELL. Yes; and they say this, and rightfully, too, that the farmer, until he works the soil up to a certain fertility, until he develops those methods which go with proper rotation and liming and balancing up by adding the more needed element, like phosphorus, for instance—until he gets his soil balanced he should not go into heavy fertilization. That is their theory, and of course, it is true to quite an extent, because merely to put fertilizer on the ground does not bring the crop. You have got to work and use your head and do all those things which go with good farming, as well as to feed the crop properly. The fertilizer business is the same as feeding cattle. A crop should be fed a balanced ration, just the same as cattle are fed. In using fertilizer it is important to know just what it is, and the farmer's concern is to get it right.

Senator NORBECK. Is it likely that the farmers are putting as much fertility back into the soil by crops as by fertilization?

Mr. MACDOWELL. I fancy more nitrogen. Our use of commercial fertilizers is not heavy. I presume, as near as I can figure, we are using 140,000 tons of nitrogen in commercial fertilizers a year. Germany alone this year will use, would you say, Major, 400,000 tons?

Major BURNS. I think 500,000.

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Mr. MACDOWELL. Five hundred thousand tons on a bit of ground not so large as Texas.

Senator NORBECK. They, of course, have their soils in better shape than we have. They are more careful farmers and have a better location.

Mr. MACDOWELL. Yes; and they farm intensively. We still farm extensively, except in some of our trucking regions.

Senator NORBECK. In other words, they are getting all the use they can out of nitrogen in producing plants?

Mr. MACDOWELL. Yes; and they make their nitrogen at home. Theirs is such a small country, and their need is to make as big crops as they can, the same as other countries do. So they resort to fertilization on a basis way beyond anything that we do here, except in a few trucking regions. In Aroostook County, Me., for instance, we fertilize on our potato crop just as heavily as they do over there.

We have counties in the South that fertilize very heavily. Marlborough County, in South Carolina, and several other counties.

The CHAIRMAN. What do they produce?

Mr. MACDOWELL. Cotton, truck, tobacco, and rotation crops. They are very fine farmers.

Senator NORBECK. It is a fact that the Germans, in spite of their intensive farming and proper rotation and intelligent handling of the soils over a long period of years, are still unable to get along without the commercial fertilizer, which means that even with the best of farming you can not get away from the purchase of fertilizer?

Mr. MACDOWELL. You can not. Germany went up from around 18 to 20 bushels per acre average for wheat under the old methods to 32 bushels per acre average for wheat under intensive fertilization. Belgium got up to 37 or 38 bushels average per acre on wheat.

Senator NORBECK. To what extent is that due to farming and to what extent is it due to the use of more commercial fertilizer?

Mr. MACDOWELL. The French Government reports that on rather intensive farming 70 per cent came through fertilization and 30 per cent through better tillage and better seeds. The German report was almost the same. I think you can safely say that fully 60 per cent of the big increase in the crops of western Europe in the last generation or generation and a half has come from the use of commercial fertilizer.

The CHAIRMAN. Mr. MacDowell, it is your estimate that in Germany alone they use 500,000 tons of nitrogen?

Mr. MACDOWELL. That is Major Burns's estimate, and I think that is about right. Of course, it is a little hard to tell how much of the nitrogen they use over there goes into fertilizer. For instance, we make in the United States in our coke ovens 100,000 tons, I think we figure, of nitrogen. Only about 30,000 tons of that 100,000 goes into domestic fertilizer.

The CHAIRMAN. How much in Germany goes into fertilizer?

Mr. MACDOWELL. It would be rather difficult to say, but my estimate was that fully 400,000 tons of their production went into fertilizer.

The CHAIRMAN. Now, we have a total consumption here, you said, of 140,000 tons of nitrogen?

Mr. MACDOWELL. A consumption in fertilizer, I would say, of about 140,000 tons. It is a bit of a guess, but it is based on averages, and it ought to work out fairly well.

The CHAIRMAN. How much surplus have we that we could put into fertilizer besides 140,000 tons?

Mr. MACDOWELL. Of course, part of this 140,000 tons is nitrate of soda which we bring in. We can bring in any quantity of that.

The CHAIRMAN. We do not produce that 140,000 tons?

Mr. MACDOWELL. No; we are both importers and exporters of nitrogen. It is rather a singular thing, but we are bringing in nitrate of soda all the time and are exporting sulphate of ammonia. The nitrogen in nitrate of soda is predigested and goes into the crop immediately. Occasionally within 48 hours after its application one can observe its effect in a deeper green color in the plant. For trucking crops and for crops in light soils, in soils deficient in organic matter, nitrate of soda is, I would say, two to three weeks quicker in its action than nitrogen which you get from sulphate of ammonia. So that there is a decided preference on the part of the truck farmers and of farmers in the sandy soils to use their nitrogen in the form of nitrate of soda rather than in the form of sulphate of ammonia. It is a question of time.

The CHAIRMAN. What I am trying to get at is, if Germany uses so much fertilizer in a little plot smaller than one State over here, it seems to me it shows, or has a tendency, at least, to show, that we are way below what we ought to be in the use of the fertilizer in our country.

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Mr. MACDOWELL. Of course, in the fertilizer industry we feel that way, and we have felt that way.

The CHAIRMAN. You still say there is so much nitrogen here we have more than we need?

Mr. MACDOWELL. We are not using it. Our farmers do not buy it. They are using a little more nitrogen this year than they did last year, because they are feeling a little better, and they saw that their small use last year was not profitable for them, and they are using a little more, calling for more units of nitrogen in a ton than last year.

The CHAIRMAN. As a matter of fact, if the farmers used the fertilizer they ought to, there would be a shortage of nitrogen, would there not?

Mr. MACDOWELL. Yes, sir.

The CHAIRMAN. According to your figures?

Mr. MACDOWELL. We would have to go to Chile and get more of that particular form; we can import from Europe. Then we could start manufacture in this country, and we would naturally have increased recovery from coking plants as they increase in numbers, plants making coke for metallurgical purposes or for domestic purposes—smokeless coal.

The CHAIRMAN. Ought we not to encourage from any source increased production of fertilizer ingredients?

Mr. MACDOWELL. Yes.

The CHAIRMAN. And get as much as we can of them, at least up to a good deal more than double the present output of fertilizer?

Mr. MACDOWELL. We should do it just as fast as we can, but we can not do it too rapidly. I mean there is no sense in doing it long before the fact, because as we stand to-day here in the first three months of this year we exported 58,641 tons of sulphate of ammonia.

The CHAIRMAN. How much did we import?

Mr. MACDOWELL. One thousand six hundred and forty-eight tons. That is, sulphate of ammonia. We don't want to confuse that with nitrate of soda.

The CHAIRMAN. How much did we import of nitrate of soda?

Mr. MACDOWELL. Fifty-two thousand and eighty-two tons in the first quarter of 1922.

The CHAIRMAN. We are all agreed, are we not, that the farmers in America do not use enough fertilizer; that they ought to use more than twice what they use now?

Mr. MACDOWELL. Well, they could use more, but they have got to sell——

The CHAIRMAN. If they used twice as much as they do now they would still be under Germany?

Mr. MACDOWELL. Oh, yes. But of course there is the practical question of the disposal of what we grow. If we increase our wheat production, for instance, our exportable surplus, from say 250,000,000 to 600,000,000, which we can easily do, could we sell it?

The CHAIRMAN. You might say, even, that we ought not to use as much as we do, in order that we might not produce as much?

Mr. MACDOWELL. No; or we might say also that we should use only half the ground that we do, because we could grow what we need on half our acreage.

The CHAIRMAN. Yes.

Mr. MACDOWELL. But many people are farming, and they want to continue to farm, and it is proper that they should. So there are questions that come in that are pretty hard to answer.

The CHAIRMAN. If we do not use fertilizer it will soon be that we won't purchase anything in many sections.

Mr. MACDOWELL. Oh, yes.

The CHAIRMAN. I presume that in time that is true in every section of the country?

Mr. MACDOWELL. Oh, yes; there is no question about that, and it is a basic, big problem; but so far as the fertilizer industry is concerned it can serve much better and serve at a lower price if the farmer will use fertilizer up to 80 per cent or 90 per cent of the producing capacity of the plants that exist to-day.

The CHAIRMAN. Yes; I can see that very clearly, but still you can not get away from the fact that there ought to be more fertilizer used, and the farmer himself knows it.

Mr. MACDOWELL. Yes.

The CHAIRMAN. He would like to have more, but can't buy it.

Mr. MACDOWELL. He can buy it, Mr. Chairman.

The CHAIRMAN. He has to pay the price for it.

Mr. MACDOWELL. He can't get something for nothing.

The CHAIRMAN. Of course he can't get something for nothing.

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Mr. MACDOWELL. He does not know what fertilizers cost. He may have a wrong impression on that.

The CHAIRMAN. He knows what they cost him. He can figure out himself that in buying fertilizer, even after he gets it, so far as the fertilizer is concerned, he still has a whole lot of risk to run, whether he is going to get anything or not.

Mr. MACDOWELL. Yes.

The CHAIRMAN. And that must be taken into consideration.

Mr. MACDOWELL. Yes.

The CHAIRMAN. When it comes to a point that he reaches that his fertilizer, among other things, costs too much, he does not buy it, of course.

Mr. MACDOWELL. Of course he is not really in position to judge whether the price he pays for his fertilizer is a fair price.

The CHAIRMAN. He is in the best position in the world to judge whether it is a fair price for him. He knows what he is going to produce under ordinary conditions better than you do.

Mr. MACDOWELL. Yes; if he really does.

The CHAIRMAN. Some of them keep books. But if he does not keep books, as some of them do, he knows in a general way.

Mr. MACDOWELL. But they don't generally keep track.

The CHAIRMAN. You might just as well say that he has no way of knowing what he should pay for a cow.

Mr. MACDOWELL. When you consider that the fertilizer industry goes to Chile for nitrate of soda for use in making sulphuric acid; goes to Louisiana and Texas for sulphur, transporting it up to the interior of the country; mines and washes the phosphate rock and dries it and ships it to the plant; buys bags from India, goes away off there to get them; makes acid phosphate and cures it in the plant; goes out and sells it and delivers it to the farmers at a price equal to 45 cents a bushel for wheat, and a big part of that is freight, I think you will realize that they are operating on as narrow a margin as any industry in the world.

The CHAIRMAN. Mr. MacDowell, it seems to me you jump at the defensive before you are attacked. The question I am asking you have nothing at all to do with whether you are making too much money, or whether you represent a trust. I am not asking that.

Mr. MACDOWELL. No. I realize that.

The CHAIRMAN. I realize that you might possibly be operating at a loss and still be selling your product at a price that the farmer could not afford to pay. If that time comes, or when it does approach, it is to your interest as well as to the interest of the farmer to get some method by which fertilizer can be cheapened.

Mr. MACDOWELL. Of course we are working on that all the time, but we have to have the material, and one thing that makes fertilizer cost more than we are getting to-day is the transportation.

The CHAIRMAN. How much has the freight business to do with the cost of fertilizer?

Mr. MACDOWELL. It averages about 35 per cent of the delivered cost.

The CHAIRMAN. That is a little over one-third.

Mr. MACDOWELL. Yes.

The CHAIRMAN. Then when the farmer pays $3 for fertilizer he is giving a little more than a dollar to the railroads?

Mr. MACDOWELL. Yes. Our freights have gone up an average of about 120 per cent since 1914. Our freight used to be about 15 to 17 per cent of the cost of the fertilizer and the materials about 65 per cent. Of course every thing during these last few years has been all out of balance. You could not tell what anything was going to cost, and everything has been changed. But right now freights are more than 35 per cent of the cost.

The CHAIRMAN. Are they as much as 40 per cent?

Mr. MACDOWELL. I would say 35. Of course the complete fertilizer is more than the acid phosphate alone, because there are some ocean freights and various other factors that enter into the equation, but it is around 35 to 40 per cent. I would say probably that with the very low price of fertilizer it is fully 40 per cent right now.

The CHAIRMAN. Do you know how much nitrate we imported from Chile during the last year.

Mr. MACDOWELL. A little more than 369,000 tons. In 1918, during the war, we imported about 1,800,000 tons.

The CHAIRMAN. We used that for war purposes, mostly?

Mr. MACDOWELL. Yes, most of it went for war purposes, and we took some away from the fertilizers; took it away from the farmers.

In 1919 part of that Government supply was sold and, as I recall, about a million tons was taken. Is not that your memory, Major? Something like that?

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Major BURNS. Yes.

The CHAIRMAN. That is in 1919. About what is the normal importation?

Mr. MACDOWELL. The normal is about 700,000 tons, of which about 175,000 tons goes into explosives. Nitrate of soda is the basis of black powder explosives; nitric acid, for dynamite, and different things of that kind, and about 90,000 tons is used normally for making sulphuric acid.

The CHAIRMAN. How much of the imported nitrate from Chile goes into fertilizer?

Mr. MACDOWELL. About 350,000 tons. It is difficult to say accurately, because some of it is sold direct from the importers and some goes from the fertilizer manufacturers.

The CHAIRMAN. How do you explain, if we already have nitrogen in the country more than we need, that so much of it is coming in from Chile?

Mr. MACDOWELL. There are different forms of nitrogen. We need the Chilean form, as it has peculiar uses, and we are bringing it in because we have to use it for certain purposes that are not served by these other forms of nitrogen. We are also using it for various manufacturing purposes. Take the manufacture of black powder——

The CHAIRMAN. I am speaking entirely of fertilizer.

Mr. MACDOWELL. For fertilizer it is used in the making of sulphuric acid, and it is used for quickening truck crops. In Aroostook County, Me., about one-third of the nitrogen for the potato fertilizer is nitrate of soda, one-third sulphate of ammonia and one-third from tankage or blood—organic forms. Experience in that cold country with their late springs proves the need for a form of nitrogen that will get to work right away and will make up for the cold, late spring and give them a crop.

The CHAIRMAN. Can they get that nitrate from the coke ovens?

Mr. MACDOWELL. No; not without great expense.

The CHAIRMAN. Could you get that from nitrate plant No. 2 if it was in operation?

Mr. MACDOWELL. No.

The CHAIRMAN. Why not?

Mr. MACDOWELL. Because it does not make sodium nitrate. It makes ammonium nitrate. I think it would be just about as quick as sodium nitrate if it was in shape to be used, but it must be oiled in order to prevent it from absorbing water, and this slows up its action. You know you must have fertilizers in proper mechanical shape. The farmers often apply this through a fertilizer drill, which is set for 150 pounds per acre or 200 pounds per acre or 300 or 400 pounds per acre. There is nothing that makes a farmer more exasperated than to have a big chunk of fertilizer clog up his drill and to find he has not fertilized some of his ground. Therefore we have to cure the ingredients and blend them in such shape that they won't cake, and that is one of the difficulties in using concentrated form of ammonia It is difficult to get the material so it will be in good mechanical condition.

There are many practical phases of manufacturing fertilizers and getting them in drillable shape, and of the right availability that do not appear at first sight, but which are practical questions.

The business does not go well through very large plants. It is not a business that can be concentrated too much at one point. Sometimes we have 10 or 12 brands in a car. The trade is shipped in a few months, and it is a big job to get out the tonnage even with many plants.

The CHAIRMAN. It seems to be the opinion of the experts that we have too many brands?

Mr. MACDOWELL. Yes; there is no question about that.

The CHAIRMAN. Is that the fault of the fertilizer manufacturer?

Mr. MACDOWELL. In part, yes. Early in the business goods were sold almost entirely by brands. The names did not indicate the analysis—but had a trade-mark or emblem. In those days, which are practically past, brands had good will value; but nowadays practically all of the fertilizer is sold by analysis.

The CHAIRMAN. Yes.

Mr. MACDOWELL. 3–9–3, if you sell it in the North, or 9–3–3 if sold in the South. That indicates the chemical analysis, and every body, practically all of the farmers, now know what that means. That has been the development of the last 8 or 10 years in the fertilizer industry. The fertilizer association is working earnestly to bring about reduction in the number of brands and increase in the concentration up to the right point. Those things are not only helpful to the farmer, but to the industry, because it interferes with the operation of the plant every time a change is made in the mixing machine to put in some irregular brand and change it for every 10 bags or so. That procedure costs a lot of money. It would be better if we could ship two or three brands to a car. Then we could be prepared beforehand to get goods out promptly. Such a system would save the fertilizer industry a great deal of money. Those things are all developing as the industry develops, and it is a young industry

It was growing at the rate of about 8 per cent a year until 1914, when the war upset things. We got up to nearly normal again in 1920, and then the depression came and it went back about 50 per cent of normal, and the industry lost millions of dollars.

The CHAIRMAN. That does not necessarily mean that you are not getting a reasonable profit, but it means that the farmer has not been making enough money so that he can pay his debts.

Mr. MACDOWELL. The farmer has not been able to pay the fertilizer people and the fertilizer people, if they can not get payment from the farmer, can not pay their debts.

The CHAIRMAN. No.

Mr. MACDOWELL. They can not do that unless they get their money from the farmers.

The CHAIRMAN. No.

Mr. MACDOWELL. So they are up against it. Very few plants were operating in the South this year. They shipped out this spring what they carried over from the year before.

The CHAIRMAN. In the Armour Co., the company with which you are connected, it is mainly the by-product of the slaughtering business, is it not?

Mr. MACDOWELL. It started that way. I developed the idea and took it up with Mr. Armour, and he told me to go to it. I employed chemists and engineers, and began to build it up. At the present time we have plants all over the country and in Cuba, and we make chemical fertilizers, and it is a large business.

The CHAIRMAN. This by-product would otherwise have been lost, if you had not branched out into the fertilizer business?

Mr. MACDOWELL. Oh, yes. That is the way we got into it.

The CHAIRMAN. And that thas been profitable, has it not?

Mr. MACDOWELL. Yes; on the whole it has been quite profitable It is a credit to the beef end of the packing business.

The CHAIRMAN. If the fertilizer company has lost anything, then, in the last two or three years, it has been because of the fact that it is interested in other things than fertilizer?

Mr. MACDOWELL. No; we lost a good deal of money in the decline in value of tankages and blood at inventory, when the slump came.

The CHAIRMAN. Yes; but that did not cost you anything, to begin with?

Mr. MACDOWELL. Yes; we bought it and paid for it.

The CHAIRMAN. As a matter of bookkeeping that happened of course.

Mr. MACDOWELL. And the value of it was credited to the beef and hog end. It was an actual loss.

The CHAIRMAN. Still the fact remains, does it not, that it was a by-product of the Armour packing establishment, and if it had not been made into fertilizer, it would have been a total loss?

Mr. MACDOWELL. Yes; the credit lowered the cost of meat. The fertilizer industry was primarily a conservation industry. It takes waste material from the cities and puts it back on the farm as fertilizer.

Take coke, the saving of 5 pounds of ammonia per ton of coal coked and sending it to the farm. That is conservation.

The CHAIRMAN. Yes; I agree with you on that.

Mr. MACDOWELL. It is very interesting from the chemical point of view.

The CHAIRMAN. As a matter of expense, now, to the fertilizer people, does it cost as much per ton of fertilizer now as it did before the war?

Mr. MACDOWELL. Well, the costs of freight are higher.

The CHAIRMAN. Is there any other difference?

Mr. MACDOWELL. Not much. The labor costs are a little higher, but that is not very important.

The CHAIRMAN. You do not have to employ skilled labor?

Mr. MACDOWELL. Not much. Of course, we have chemists and electricians, and they are skilled, but the rank and file are common, every-day men, the men who do the heavy work. It is a basic industry. As I say, it is overly developed for the time being. In some ways it has not been well developed. It has had its weak points. Its methods of selling are not, perhaps, what they should be. The unlimited credit practiced is expensive. It costs money to keep track of all those things, but the main effect is that too many companies, too many competitors, try to sell the same man. Every time they go to see him it costs money. Whether they get the business or not, that expense is there.

The CHAIRMAN. Is there any indication of a tendency on the part of the fertilizer people to eliminate the freight in the sending to farmers or to local organizations of farmers fertilizer in concentrated form, so that they can mix it?

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Mr. MACDOWELL. Oh, they can always, and many do now, buy the ingredients and do their own mixing. There is a certain amount of it done on the farm, where they want the higher grade of materials.

The CHAIRMAN. Most of the freight comes in the cost of shipping what is known as the filler, does it not?

Mr. MACDOWELL. Well, that is a part of it; but that is not so important as you might think. A good deal of expense is involved before you get to the point of shipping anything out, in the bringing in of phosphate rock, and sulphur and nitrate for sulphuric acid. All of those elements are essential to the making of acid phosphate.

The CHAIRMAN. Of course, they are but a very small part of the freight.

Mr. MACDOWELL. Oh, no; they are pretty big parts, because that is over 50 per cent of the total volume of the fertilizer industry. The freight charge bears more heavily upon the incoming materials. All of the ingredients for complete fertilizer are brought in from outside, many of them from long distances. The outgoing freight charge is a smaller proportion of the whole, because one of the developments of the industry which makes for economy is the establishment of numerous plants throughout the country which serve as distributing points for local needs, and the freight rate on outgoing shipments is accordingly reduced.

The CHAIRMAN. How much filler is there in a ton of fertilizer, in addition to the three fertilizer ingredients?

Mr. MACDOWELL. Do you mean as the elements, or combined with other things?

The CHAIRMAN. Either.

Mr. MACDOWELL. About 300 pounds of elementary fertilizer, and the balance is about 1,700 pounds of carrier.

The CHAIRMAN. Yes.

Mr. MACDOWELL. There may not be a pound of filler in that.

The CHAIRMAN. Perhaps I was not correct in using that particular term. I mean something that does not do the plant any good, something that has no nourishment in it for what the farmer is going to raise.

Mr. MACDOWELL. Most of these things have value, aside from the three essential things. They have a certain value. Take bone for instance. There is a great deal of lime and minerals in bone. It may have 500 pounds of nitrogen and phosphoric acid in it and 1,500 pounds of lime.

The CHAIRMAN. But if a farmer were going to use lime on his soil he would not ship it across the country. He would get it locally.

Mr. MACDOWELL. He would get it as near by as he could.

The CHAIRMAN. Yes.

Mr. MACDOWELL. But the cost of purifying bone and taking out the lime would be too much, and it is the same with other materials. Except on long freight hauls it would not pay to do it. Do you see what I mean?

The CHAIRMAN. No; I am afraid I do not see what you mean there.

Mr. MACDOWELL. For instance, take potash. You get it from the mines. It comes out here 20 per cent potash. That is run of mine stuff.

The CHAIRMAN. Yes.

Mr. MACDOWELL. You can buy that at a certain price per unit for manufacture delivered here. To concentrate they will take 3 tons of 20 per cent and concentrate it to 50 per cent.

The CHAIRMAN. Yes.

Mr. MACDOWELL. And you will have to pay more here per unit for the 50 per cent than you do for the 20 per cent, at port. Now, for the port plant, you would use the 20 per cent in goods, because it would be cheaper to ship out anywhere within a proper distance of the port plant; but if you wanted it to go back to Nashville or Atlanta, you would find that it would be a saving in freight to ship the 50 per cent material instead of the 20 per cent. Concentration is one of those processes where you have to figure your freight against it. They have been making concentrated phosphate fertilizers in Holland and Belgium for years, 45 per cent phosphoric acid goods, but the Belgian farmer does not use it. It is only used in New Zealand and Australia and for a time it was used in Japan, where the big saving in freight cost made it more profitable for them.

The CHAIRMAN. When they got it there they mixed it there?

Mr. MACDOWELL. They then reduced it there. That was purely a freight proposition.

The CHAIRMAN. Yes.

Mr. MACDOWELL. Now, the Belgian farmer, and he is a good one—does not buy these concentrated phosphoric acid fertilizers. He takes the 16 or 18 or 20 per cent grade.

The CHAIRMAN. I can easily then see how that would occur. He would think that those people could mix it cheaper than he can. But all of Belgium is just an ordinary

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American county, and freight does not cut much of a figure in it; but when you have to make fertilizer in Chicago and ship it to Alabama——

Mr. MACDOWELL. Of course, we would not do that.

The CHAIRMAN. About how far do you ship it?

Mr. MACDOWELL. To the central part of Indiana and northern Ohio and Michigan.

The CHAIRMAN. What about Maine?

Mr. MACDOWELL. We have a plant at Searsport and one at Bucksport, Me.

The CHAIRMAN. What do you ship to Searsport?

Mr. MACDOWELL. We ship from our New York plant our acid phosphates. We may take our sulphate of ammonia and our nitrate of soda and our blood and potash and mix those up, and then barge them up to Searsport or to Bucksport.

The CHAIRMAN. What do you do with it there?

Mr. MACDOWELL. We put them into the plants and let them stand there, and ship out when the orders come in.

The CHAIRMAN. What do you mix it in?

Mr. MACDOWELL. Not anything ordinarily. We ship our concentrated fertilizers up to them.

The CHAIRMAN. Then, the Maine farmer has to pay the freight from New York?

Mr. MACDOWELL. Yes; the Maine farmer has to pay the freight from New York.

The CHAIRMAN. On everything that he puts into the ground?

Mr. MACDOWELL. On everything that he puts into the ground. We mix some goods at Searsport. We may bring potash there, but that is not a good port. It has to go to Boston and be transported, but we have a plant there that will take care of all that the farmers need.

The CHAIRMAN. It seems to me in this country, where it is admitted that 40 per cent of the cost to the farmer is freight, we ought to eliminate freight if we possibly can by shipping in concentrated form.

Mr. MACDOWELL. That is what we try to do.

The CHAIRMAN. And cut out all of this filler.

Mr. MACDOWELL. That is what we do in shipping to the small plant where we make goods. That is our method of assembling. Baltimore is the largest producing center. They can make pretty close to a million tons at that point. There is no earthly reason for a million tons of production at Baltimore. There is about 500,000 tons of normal consumption near there [indicating on chart].

The CHAIRMAN. That means that they ship a good deal of it quite a distance?

Mr. MACDOWELL. Yes.

The CHAIRMAN. Out beyond where there are mixing stations?

Mr. MACDOWELL. Yes. The chart shows a production of 895,000 tons out of Baltimore. Now, there are 212,000 tons at Norfolk, and 132,000 tons out of Chicago. Here is one——

The CHAIRMAN. You did not give the name of the place.

Mr. MACDOWELL. Nashville, Tenn., 168,000.

The CHAIRMAN. Here are some in South Carolina [indicating on chart]

Mr. MACDOWELL. Yes.

The CHAIRMAN. And Georgia.

Mr. MACDOWELL. Yes.

The CHAIRMAN. Right along the coast, and very large ones.

Mr. MACDOWELL. Yes sir; they get their phosphate rock from Florida, right in here [indicating on chart].

The CHAIRMAN. They do ship that amount by water?

Mr. MACDOWELL. They ship that amount by water. They move it up here [indicating on chart] at $2.

The CHAIRMAN. Up to Baltimore?

Mr. MACDOWELL. Up to Baltimore, from Tampa.

The CHAIRMAN. From Tampa, Fla.?

Mr. MACDOWELL. Yes; $2. That is the ocean rate—— $2 to $2.10. That is back to pre-war rate. It costs $2.975 to ship a ton of phosphate rock by rail from Tampa to Jacksonville.

The CHAIRMAN. From one part of Florida——

Mr. MACDOWELL. To Jacksonville by rail, where we manufacture it.

The CHAIRMAN. Now much does it cost?

Mr. MACDOWELL. I think it is $2.975.

The CHAIRMAN. For how many miles?

Mr. MACDOWELL. It is not a very long haul, 248 miles.

The CHAIRMAN. That is a fair illustration of what is going on all over the country in the freight business.

Mr. MACDOWELL. Yes. Now, here in Tennessee, right here [indicating on chart], that is where the phosphate comes from. It is more expensive to mine Tennessee

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phosphate because it is not in big deposits, but we are using at Atlanta phosphate rock which comes from here [indicating Florida on chart], because it is cheaper than phosphate rock coming from here [indicating Tennessee]. We are moving, as I say, all of this material around here to those different ports. The potash comes in by water from Germany and France. About half of it comes from France, and the sulphate of ammonia and cottonseed meal and other things are shipped right to those plants. A good deal of the South American tankage comes here [indicating on chart].

The CHAIRMAN. Do you get any potash in your fertilizer business that is not imported?

Mr. MACDOWELL. I do not know as I understand your question. Cottonseed meal carries a little potash.

The CHAIRMAN. Suppose the supply from Germany and France were cut off? Where would you go for potash?

Mr. MACDOWELL. We would do what we did during the war. I personally started the first potash mine in the United States, down in south Utah.

The CHAIRMAN. Is there any operation there now?

Mr. MACDOWELL. Oh, no. They are closed down tight, on account of the German and French prices; but it rendered a big service during the war.

The CHAIRMAN. Well, we had it in abundance, too.

Mr. MACDOWELL. Yes. Then, there is Nebraska deposit. That development followed ours along simultaneously; but here is where the potash is used, Senator, right along the coastal plain running from Maine and to the Gulf [indicating on chart]. Here is the biggest potash consuming section, and here is our big potential production—California (indicating on chart]. That is where the big manufacturing is done. You will notice that this is not at all tributary to the Muscle Shoals section. In other words, you will have to go a long ways in order to get over to where the big bulk of the fertilizer is used.

The CHAIRMAN. All of this territory within a reasonable distance of Muscle Shoals is territory that ought to use a great deal of fertilizer.

Mr. MACDOWELL. It ought to, but Alabama has gone back, and uses less than some years ago. But this year, it is showing up a little better.

The CHAIRMAN. It seems to me that this all goes to the proposition that it is too expensive to use it.

Mr. MACDOWELL. No; it is the mental attitude which present conditions have developed in the farmer.

The CHAIRMAN. But that comes back to the question of making both ends meet in farming, does it not?

Mr. MACDOWELL. Yes.

The CHAIRMAN. It costs the farmer more to produce than his goods are worth?

Mr. MACDOWELL. Yes.

Senator HEFLIN. His purchasing power has been lessened.

Mr. MACDOWELL. Yes.

The CHAIRMAN. That is not the only thing, of course. Freight is the biggest item in regard to his fertilizer, and it hits him just as hard as anything else.

Senator HEFLIN. Another thing that accounts for the small consumption in Alabama is this: We usually produce 1,500,000 bales of cotton there. Last year, we produced about 450,000 bales. The farmer will not buy fertilizer, and he can not raise it without the fertilizer.

Mr. MACDOWELL. Yes.

Senator HEFLIN. He does not want to buy the fertilizer to feed the boll weevil.

The CHAIRMAN. That is the idea.

Mr. MACDOWELL. And you can not blame him. Of course, we are studying that whole thing as best we can.

The CHAIRMAN. And he will not raise enough to feed the boll weevil unless he does buy fertilizer.

Senator HEFLIN. Do you mind telling the committee what you think should be done?

Mr. MACDOWELL. The fertilizer educational bureaus do not maintain experimental farms. Their feeling is that this work should be carried on by the Government and State experiment stations. They do, however, maintain agricultural fellowships at several of the State experiment stations, furnishing funds for special investigations, the result of which will be published by the stations when concluded. Some of these fellowships are studying methods of applying fertilizer for the different crops in various types of soils; fertilizer formulas; concentration of plant food and its advantages and dangers. Some manufacturers are, however, making practical demonstrations in the cotton section of how to combat the boll weevil, using the methods worked out by the Government and States. My own company is doing this on a 6,000-acre cotton farm in Georgia, where some 75 negro tenants work the land. The idea is to demon-

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strate that the weevil can be controlled and cotton profitably grown by using methods within the financial means of the average small owner or tenant farmer.

The plan carries with it the planting of other crops, that the farm may be more self-supporting. The work is in charge of Dr. DeLoach, former director of the Georgia Agriculture Experiment Station, now in charge of agricultural research for the Armour Co. The Georgia station and the Department of Agriculture are cooperating.

A get-together meeting of the tenants, through a barbecue, was held, and the plan of operation explained. This has been followed by other meetings as the work progressed. Great enthusiasm has been aroused, and so far everything is working out as planned. A simple hand calcium arsenate duster was made from an empty molasses can, riveted to a stick, with a piece of cheesecloth as a sieve fastened on the bottom. This cost about 15 cents. The tenants were shown how to use it on small cotton plants by jarring the stick on the ground and shaking a little of the poison on the plant. This struck the negroes as practical, some 150 were made, and the pickaninnies were put to work when the first boll weevil appeared. A pound of poison to the acre is used on one application by this method.

Senator HEFLIN. And when the boll weevil eats the leaves he becomes poisoned and drops off?

Mr. MACDOWELL. Yes; when the cotton plant gets larger the regular dusting machine will of course be used. Certified seed has been planted, the best soils for the cotton fields were selected, proper fertilizers have been furnished, and so far everything is working out on schedule. The experiment is attracting a great deal of attention and the plantation is being visited daily by planters. Expenses are being kept down. The aim is to get as near a bale of lint cotton to the acre as possible, and thus reduce the cost to grow.

The CHAIRMAN. What do you think the Government ought to do with Muscle Shoals, Mr. MacDowell?

Mr. MACDOWELL. I think the ammonium-nitrate plant at Muscle Shoals should be held in reserve.

The CHAIRMAN. Do you think it should be kept in stand-by condition?

Mr. MACDOWELL. It should be kept in stand-by condition. I think the Government should go ahead and develop the water power sensibly. I do not mean a tremendous amount of secondary power that may not be used except for a few months in the year, but well-balanced power. I think, rather than put in the secondary-power electrical equipment, it would be better to go upstream and put in dams.

The CHAIRMAN. What would you do with the power when you have had it developed?

Mr. MACDOWELL. I am quite sure that if you develop that power and it is sold with no discrimination and to the advantage of that section, it will be taken care of.

The CHAIRMAN. You mean by that that there would be a market for it?

Mr. MACDOWELL. That there would be a market for it.

The CHAIRMAN. At a fair value?

Mr. MACDOWELL. At a fair value; yes, sir; and you will get diversified industries in there, and you can always hold back enough power that you can take at any time for Major Burns to run his nitrogen-fixation plant.

The CHAIRMAN. Oh, yes.

Mr. MACDOWELL. There is no difficulty about it. There are steam plants there now. You can start in two or three weeks to make it.

The CHAIRMAN. Yes.

Mr. MACDOWELL. It is so valuable in an emergency that I think, by all means, it should be conserved and kept in shape, but I do question whether it is good business to run it when there is no need for the product, and there is the expense of coal, labor, and different things of that kind. Furthermore, I think, from the Government's standpoint or from the standpoint of the private individual who may, when the nitrogen is used in a larger way, want to make it, that probably those electrical-power processes will not be in order. The Haber process, as Major Burns will tell you, now requires one-fifth of the power that the cyanamid does, and it does not destroy nearly as much raw material. I mean by that you will not burn up as much coal or as much lime or use as much transportation in making it.

When the Muscle Shoals plant was started it was necessary to have additional production not dependent on Chile. The cyanamid process was installed, as that was the only one we really knew how to run as it was being run in this country. The Haber method was really undeveloped.

The CHAIRMAN. Yes.

Mr. MACDOWELL. I was in full sympathy with the building of the cyanamid type of plant. The plant should be held in reserve, and if there is need for the product, either for fertilizer or otherwise, it can be made use of; but I am not in sympathy

with developing this water power and letting one man control it. I think it should be run for the general good of the region. That is my feeling.

Senator HEFLIN. If you had known, then, when you helped to institute this work that Ford was liable to get it, you would not have had anything to do with it, would you?

Mr. MACDOWELL. Well, I do not think that that, Senator, would have made any difference at all. I was in this war helping all I could, and I was for anything and everything that would be successful in getting us in shape as quickly as possible to do good fighting.

Senator HEFLIN. If Mr. Ford should get it and start to manufacture fertilizer on a large scale, building up other industrial works down there and giving employment to a lot of people, and help to bring the price of fertilizer down to the farmer, don't you think that that would be putting this project to good use?

Mr. MACDOWELL. Well, I am very doubtful, Senator, if Mr. Ford can very materially cheapen the price of fertilizer, from my knowledge of how these things are made. We can talk about secret processes, and we can talk loosely about a good many things, but the basic cost of fertilizer is very well known.

Senator HEFLIN. Yes.

Mr. MACDOWELL. And the possibilities of decreasing the cost are pretty well known. We know to-day that the way to decrease the cost of the fertilizer to the farmer is to put a lot more fertilizer through the plants and cut the cost down. As it is now, there is too much overhead, and not enough going through. When you talk about Mr. Ford's materially cheapening it, I can not see how he can do it, but I can see how Mr. Ford could very seriously disturb the fertilizer industry. As you know, that is the easiest thing in the world to do with any industry, if you have power enough to come in and do it, but I do not see that he is offering anything that we do not already know. I do not see that he is offering to do anything that other elements in the industry can not do, providing they have the facilities, and if there is need for a more concentrated fertilizer we can make it of double strength, and we are making it now for the farmers who want it. Our truck fertilizers are quite concentrated. All this is a part of education. It takes time; it is a slow proposition.

Now, I do not believe Mr. Ford could go ahead and make these concentrated fertilizers and sell them. I do think that our company, or any other company that is qualified to do things, can make concentrated fertilizers at Tampa, Fla., just as cheaply as Mr. Ford can, as far as the making is concerned, but I would be slow about doing it, because I would be very much afraid that we could not sell the product, because to change over to a new method of use involves a certain amount of time and study on the part of the farmer.

Senator HEFLIN. And it is quite natural for the industry with which you are connected to wish to keep out anybody from coming in competition with it?

Mr. MACDOWELL. Oh, yes; but we can not help that part of it. Anybody who wants to can get into the fertilizer business.

Senator HEFLIN. Mr. Mayo, the chief engineer for Mr. Ford, stated to this committee that they can produce fertilizer there for half of the present cost and could sell it to the farmer at half the present price, but you do not think that is possible?

Mr. MACDOWELL. I do not think it is anywhere near possible; no.

Senator HEFLIN. He might do it, though; he brought down the price of automobiles.

Mr. MACDOWELL. Yes; of course, he has done that.

Senator HEFLIN. And nobody could do that before him?

Mr. MACDOWELL. But he has an assembling and repetition process there which does not apply so well to the fertilizer industry. His problem is much simpler. He sells a $350 article—we a $25. He makes one model; we make many brands. He ships steadily; we ship our year's make in four months. He sells for cash—we on credit. Our problem is proper selling representation. It has been reported to me that 20 salesmen would call on one merchant in one town in a territory in one week, representing 20 different fertilizer companies, selling fertilizer. Don't you think that duplication of work enters into the cost of selling the fertilizer?

Senator HEFLIN. Oh, yes.

Mr. MACDOWELL. That is the trouble; there is so much competition; everybody is after the business, and they all go to great lengths to get it. The minute the demand increases and this pressure is lifted a little it won't be so expensive, but when we have 50 per cent demand and 100 per cent capacity pushing up expenses everybody scratches gravel trying to get what little business there is. It is impossible, of course, to work well under those circumstances.

Senator HEFLIN. We are anxious to build up the country industrially and agriculturally and to help the cause of labor, and Mr. Ford seems to be about the only one who offers any hope along that line.

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Mr. MACDOWELL. I do not know how much you could count on a large labor employment there through these chemical processes. As a rule, they do not use much labor.

Senator HEFLIN. Well, he would probably make other things there. He might build a cotton mill there.

Mr. MACDOWELL. Oh, yes; or he might make motor parts, too.

Senator HEFLIN. Yes; he might make motor parts there or various other things.

Mr. MACDOWELL. Yes.

Senator HEFLIN. He might build an industrial city there, and he might give employment to thousands of people there. If a man like that could get this project, it seems to me that it would serve the needs of more people than any other use that we could put it to.

Mr. MACDOWELL. Well, of course, that is rather problematical. It is hard to tell. The fertilizer industry wants to see that section developed, and it naturally wants to get industry started down there. It helps the farmer to have a near-by market and it is always desirable to have a diversity of interests. If seems to me it would be better to try to have many diversified interests in there. I think you would be stronger and safer during hard times and would have steadier labor employment, and you would have a bigger pay roll than you would have by giving the power to one man and letting him develop it largely along metallurgical lines, because that is probably what would happen.

Senator HEFLIN. Suppose Mr. Ford gets it and uses part of the power for making fertilizer and part of it for making automobile parts, and partly for spinning cotton. In that event he would give a great many people employment all the time, would he not?

Mr. MACDOWELL. Yes; all of those industrial developments are worthy of every study and consideration, of course, but I can not help but feel that it is better for that section of the country to have the power developed and thrown into general service, rather than to have it developed by one set of men, giving them the right to say what kind of an industry shall be developed down there.

The CHAIRMAN. But you must remember, Mr. MacDowell, it only runs for a hundred years.

Mr. MACDOWELL. Yes, I also pay tribute to the modesty of that provision, but seriously, who knows what the situation will be in even 50 years. What will the power be worth then? Will the coal be largely exhausted? One hundred years is a long time.

The CHAIRMAN. Is there anything else, Senator Heflin?

Senator HEFLIN. I believe not, Mr. Chairman.

The CHAIRMAN. Do you think of anything else that you want to say, Mr. MacDowell?

Mr. MACDOWELL. No; I think I have said a whole lot. I did not intend to fill up the record with this conversational material.

The CHAIRMAN. We have no further witness for to-day.

Mr. MACDOWELL. Can you suggest anything, Major Burns, that I have overlooked?

Major BURNS. I would like to know what you think is the best possible scheme for cheapening the price of fertilizer.

The CHAIRMAN. Yes; we would like to have you tell us that, if you can.

Mr. MACDOWELL. I can not suggest anything concrete. The first thing to get fertilizer costs down is more business.

The CHAIRMAN. Of course, in that respect, it is like a good many other things?

Mr. MACDOWELL. Yes; the use of higher grades will reduce plant food costs on the farm too. Right now, the fertilizer industry is in real bad shape. It has lost $75,000,000 this last year.

The CHAIRMAN. And to a great extent that loss comes about due to the fact that the farmer has not been able to pay for it?

Mr. MACDOWELL. First the farmer did not feel able to buy much of the product, and then he was unable to pay for what he did take at the low price. Also he was unable to pay for what he had the year before. A lot of it had been used under cotton when the cotton was up around 30 cents.

The CHAIRMAN. That has been unquestionably true of farming all over.

Mr. MACDOWELL. Yes.

The CHAIRMAN. They have not received enough for their products to pay for the cost of producing them.

Mr. MACDOWELL. Yes; that is right, and they fertilizer people are in the same shape.

The CHAIRMAN. On the other hand, because the farmer could not get cheaper fertilizer is one of the elements that caused him to quit.

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Mr. MACDOWELL. Well, he has not had much to do with.

Senator HEFLIN. In my state, in 1920, Mr. Chairman, the cotton crop brought $32,000,000, and the fertilizer bill was $20,000,000. That crop sold for more than 18 cents a pound under the cost of production.

Mr. MACDOWELL. Yes.

Senator HEFLIN. It cost more to get that crop than any other crop that we ever produced.

Mr. MACDOWELL. Well, it was the same way with us on the fertilizer that was sold for that crop. It cost us more to make it than ever before.

Senator HEFLIN. Yes.

Mr. MACDOWELL. The labor was higher and everything was absolutely out of line, as you know. We could not get a piece of machinery to repair a plant without paying two or three prices for it.

The CHAIRMAN. As we have no further witness for today, and we do not know just when we will be able to get the next witness here, the committee will stand adjourned, subject to call.

(Whereupon, at 4.15 o'clock p. m., the committee adjourned subject to the call of the chairman.)

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MUSCLE SHOALS.

FRIDAY, MAY 19, 1922.

UNITED STATES SENATE,
COMMITTEE ON AGRICULTURE AND FORESTRY,
Washington, D. C.

The committee met pursuant to the call of the chairman at 10.30 o'clock a. m., in room 224 Senate Office Building, Senator George W. Norris (chairman) presiding.

Present: Senators Norris, Ladd, McKinley, Kendrick, and Heflin.

The CHAIRMAN. Doctor Tolman, we will be very glad to hear you.

STATEMENT OF DR. RICHARD C. TOLMAN, DIRECTOR FIXED NITROGEN RESEARCH LABORATORY, DEPARTMENT OF AGRICULTURE, WASHINGTON, D. C.

Doctor TOLMAN. I think I would be of most help to the committee if I could give a brief statement as to the different processes of fixation of nitrogen, comparing one method with the other, and then state very briefly what we had planned at Muscle Shoals in the way of utilizing the Muscle Shoals plant.

The CHAIRMAN. That would be very agreeable, Doctor. To begin with, however, for the record, state just who you are.

Doctor TOLMAN. Richard C. Tolman, director fixed nitrogen research laboratory, Department of Agriculture.

The CHAIRMAN. How old are you, Doctor?

Doctor TOLMAN. I am 41.

The CHAIRMAN. Where were you educated?

Doctor TOLMAN. At the Massachusetts Institute of Technology.

The CHAIRMAN. When did you graduate from the Massachusetts Institute of Technology?

Doctor TOLMAN. In 1903.

The CHAIRMAN. Then where did you go?

Doctor TOLMAN. I went to Germany and studied there.

The CHAIRMAN. Where did you pursue your studies in Germany?

Doctor TOLMAN. At the University of Berlin and at Crefeld.

The CHAIRMAN. Then where did you go?

Doctor TOLMAN. And then I came back to the Institute of Technology at Boston, where I received my doctor's degree in 1910.

The CHAIRMAN. What have you done since then?

Doctor TOLMAN. I then taught in the University of Michigan, University of Cincinnati, University of Californa, and Unversity of Illinois, and was later in Chemical Warfare Service, and then at the fixed nitrogen research laboratory.

The CHAIRMAN. And you were professor at those various places?

Doctor TOLMAN. Yes, sir.

The CHAIRMAN. In what particular line?

Doctor TOLMAN. Chemistry.

The CHAIRMAN. You are a chemist?

Doctor TOLMAN. Yes, sir.

The CHAIRMAN. And your education has been along chemical lines?

Doctor TOLMAN. Yes, sir.

The CHAIRMAN. Tell us just what that laboratory is?

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Doctor TOLMAN. The fixed nitrogen research laboratory.

The CHAIRMAN. Yes. That is a Government institution?

Doctor TOLMAN. It is a Government laboratory which was originally in the Nitrate Division of the Ordnance Department. It was transferred on the 1st of last July to the Department of Agriculture. It was established by Mr. Arthur Graham Glasgow, fixed nitrogen administrator, to assist in solving the problems of the Government necessary for the reconstruction of United States nitrate plant No. 1, and those necessary to adapt United States nitrate plant No. 2 for commercial operation in peace time, and to study methods for the fixation of nitrogen in general.

The CHAIRMAN. Go ahead with your own outline.

Doctor TOLMAN. I should like to describe these charts, which illustrate the different methods of nitrogen fixation.

This chart represents the arc method of fixing nitrogen, which is the oldest method of nitrogen fixation.

The CHAIRMAN. In all of these processes when you say "fixation of nitrogen" you mean fixation from the air?

Doctor TOLMAN. Taking nitrogen from the air and putting it into chemical combination. When it is once in chemical combination it can then be transformed from one form to another.

In the arc processes the only raw materials are water and power. The air is heated in the electric arc, where nitric-oxide is formed, and on cooling this is further oxidised to nitrogen dioxide. This is absorbed in water to give dilute nitric acid. Calcium nitrate or concentrated nitric acid can then be prepared, and ammonium nitrate can be manufactured provided ammonia from some other source is available. Sodium nitrite is also available as a by-product.

This method of nitrogen fixation uses the most power of any method of nitrogen fixation commercially used. It takes 67,000 kilowatt hours per short ton of nitrogen fixed. It fixes the nitrogen directly in the nitrate form, and makes, as its main fertilizer product, calcium nitrate, which is a material that will not fit into American methods of using fertilizer.

The CHAIRMAN. Could you change it so it would?

Doctor TOLMAN. We have made experiments on graining and oil-coating this material, to decrease its tendency to take up water and to put it in form in which it could be used as fertilizer under American conditions. It is a highly deliquescent material. Our success along these lines has not been very marked, and I think it would be very difficult to prepare it in form so that it could be extensively used.

I should say that the usefulness of this process is limited to the following conditions: Very cheap water power and necessity of having your nitrogen in the nitrate form. In other words, in places in this country where you have very cheap water power and want to use nitric acid for the manufacture of explosives, this would be a method which would be well worth considering; but as a method for making fertilizer for use in this country, it cannot be recommended.

Senator LADD. Is this method commercially employed at the present time?

Doctor TOLMAN. In this country there is one plant operating by this method out in Seattle, and another plant belonging to the same company across the border in Canada. The plant in Seattle has a capacity of about 300 tons of fixed nitrogen per annum.

The CHAIRMAN: How cheap would you have to have your power in order to produce nitrogen that would produce a fertilizer that could be sold on the market at less than the present price of fertilizer?

Doctor TOLMAN. By this method?

The CHAIRMAN. Yes; by the method you have described.

Doctor TOLMAN. I should say that this method was not adapted for making fertilizer for use in American agriculture. The main fertilizer product made by this method is calcium nitrate, which will fit into the intensive methods of agriculture used in Europe, but will not fit into our agricultural methods. It takes up too much water.

Senator LADD. Does it take up more water than ammonium nitrate?

Doctor TOLMAN. Yes, sir. We have made some experiments in graining and oiling this material and in graining and oiling ammonium nitrate, and we have been more successful in graining and oiling ammonium nitrate. Not only is the graining of the ammonium nitrate an easier process but after coating and oiling the ammonium nitrate is more satisfactory.

Senator LADD. Is this method commercially employed in Europe?

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Doctor TOLMAN. Yes; this method is used in Scandinavia on a large scale and apparently with success.

The CHAIRMAN. Do they make fertilizer out of it?

Doctor TOLMAN. Yes, sir. They make calcium nitrate, which will go into European agriculture, where they apply fertilizer more by hand and less by machine.

Senator HEFLIN. The cheaper power over there enables them to use it, whereas they could not use it here because the power costs too much?

Doctor TOLMAN. It is not entirely a matter of power, but is determined by the fact that the final material fits into their method of agriculture, but does not fit into our method of agriculture.

I believe if you want nitric acid for making explosives, and are going to use it at the point of manufacture and don't have to transport it, you should give serious consideration to this process; but as to helping the farmer, I think it has nothing in it.

This method of nitrogen fixation shown by this second chart, the cyanamide process, was the next process to be developed.

The CHAIRMAN. That is the process fixed at plant No. 2?

Doctor TOLMAN. Yes, sir. In this process the raw materials are limestone, coke, and air. The limestone is burned, mixed with the coke, and put into an electric furnace, where ordinary calcium carbide, such as is used for making acetylene, is produced. This calcium carbide is then put into an oven and nitrogen obtained from liquefaction of air, is passed through the oven, fixing the nitrogen in the form of calcium cyanamide. After you have got your nitrogen fixed in the form of calcium cyanamide, you can then transform it into any other form that you desire. You can autoclave it with steam and make ammonia gas, and then this ammonia gas will lead to a variety of products, such as anhydrous ammonia, ammonium sulphate, and ammonium phosphate. By oxidizing part of your ammonia with air in the presence of a platinum gauze, you can make nitric acid, and then absorb a further portion of your ammonia in the nitric acid and obtain ammonium nitrate. By combining your ammonia with carbon dioxide and further treatment you can produce urea.

Instead of autoclaving your calcium cyanamide with steam, you can also make a variety of products directly from the cyanamide itself. You can make cyanamide fertilizer merely by taking the calcium cyanamide and hydrating it and coating it with oil. This is the material made and sold by the American Cyanamid Co.

You can make free cyanamide, which has the chemical formula H_2CN_2, and this material becomes the base material for a variety of chemicals.

You can also make urea by a different process from that described before, without going through the stage of ammonia gas but by treating cyanamide directly with acid.

By treating the cyanamide with alkali you can make dicyanodiamide, which is an important base material for the manufacture of dyes, explosives, and chemicals.

By fusing the cyanamide with sodium chloride a crude cyanide can be made, suitable for the leaching of gold and silver ores, and this in turn can be treated with acid to give hydrocyanic acid, which is used in the fumigation of citrus fruit trees.

I should like to point out one particular thing with regard to the cyanamide method of nitrogen fixation. These materials shown on this line [indicating chart] can be obtained from the cyanamide method of nitrogen fixation and can not be obtained from other methods of fixation. In the cyanamide method of nitrogen fixation the nitrogen atom is combined directly with the carbon atom, and thus gives the possibility of a variety of organic chemicals which can not be obtained from the arc process or the Haber process.

For instance, from this material free cyanamide, you can make guanidine and nitroguanidine, and we have developed methods for making free cyanamide in a cheap way. It has hitherto only been made on a laboratory scale.

We have also developed the method for making guanidine and nitroguanidine. If in the future smokeless powder should contain one-third nitroguanidine, the total capacity of the Muscle Shoals plant would be nowhere near enough to keep an army of 50 divisions in the field, and at the present time the only other source of nitroguanidine on this continent would be the American Cyanamid Co. in Canada.

This method of nitrogen fixation takes less power than the arc process, namely, 15,000 kilowatt hours per ton of nitrogen fixed. It leads to all the

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nitrogen products that any method of nitrogen fixation can produce, and it will lead to some that the other methods of nitrogen fixation can not produce.

Later on I will give comparative figures between these various processes.

The CHAIRMAN. If you intend to give it later on, but in the meantime we would like to have you explain what the possibilities are of the utilization of this cyanamid process for making fertilizer.

Doctor TOLMAN. Later on I have a chart that will show that better.

The CHAIRMAN. All right. I don't want to interfere with your outline, but don't forget that.

Doctor TOLMAN. This chart shows the so-called Haber process of nitrogen fixation, which is the latest method to be developed.

The CHAIRMAN. That is the process of plant No. 1?

Doctor TOLMAN. Yes, sir; the process at plant No. 1.

This particular modification of the Haber process is called the Haber-Bosch process, Bosch having been the man who introduced this particular method for making the mixture of nitrogen and hydrogen going to form ammonia, and this is the modification of the process which was planned at Sheffield at nitrate plant No. 1.

In this process the raw materials are coke and air and steam. The air and steam are blown through a gas producer containing coke, giving a mixture of nitrogen, hydrogen, and carbon monoxide, containing such impurities as carbon dioxide, sulphur compounds, and other impurities from the coke.

The next step in the process is to take this mixture of gases which contained about equal parts of hydrogen and carbon monoxide and pass it through a catalyst with excess steam, where the carbon monoxide reacts with the steam to give you an equal volume of hydrogen together with carbon dioxide. In this way you double the amount of hydrogen.

The water is then condensed out, the mixture is compressed, and the carbon dioxide removed by water scrubbing, followed in some cases by caustic scrubbing, and finally followed by scrubbing with cuprous ammonia solution to remove the carbon monoxide. After this treatment we then have a mixture of three parts hydrogen and one part nitrogen, which has to be very pure. It is then passed into the circulating system, where it circulates through a catalyst, and the ammonia is formed from the nitrogen and hydrogen.

The CHAIRMAN. You have not any power in that as one of your raw materials.

Doctor TOLMAN. The amount of power used in this particular modification of the Haber process is relatively small—about 4,500 kilowatt-hours per ton of nitrogen fixed. That power goes into running blowers, compressors, and things of that kind.

The CHAIRMAN. What is the quantity of steam you have to have?

Doctor TOLMAN. You have to have large quantities of steam. I can not tell you offhand. Four volumes of steam to one volume of gas. I would have to look it up and tell you actually the pounds of steam you use per pound of ammonia.

In this modification of the Haber-Bosch process the main cost of the process occurs before you start to get you ammonia from nitrogen and hydrogen. From figures that were made for the Sheffield plant it was estimated that 20 per cent of the cost of the process went into making the water gas; 50 per cent of the cost of the process then went into changing the carbon monoxide in that water gas to hydrogen and purifying the mixture to make it ready to enter into the final stage of the process. So that 70 per cent of the total cost of the process occurred before you began to circulate your gas through the system. These figures may be a little bit higher in that particular plant than they may be for other plants, but that gives you an idea of the relative distribution of costs.

Senator HEFLIN. Has you been to Muscle Shoals?

Doctor TOLMAN. Yes, sir. I have been only a few times to Muscle Shoals.

Senator HEFLIN. You have seen the Haber plant there?

Doctor TOLMAN. Yes, sir.

Senator HEFLIN. Do you think it could be made to operate successfully?

Doctor TOLMAN. Yes, sir; by spending enough money.

Senator HEFLIN. How much money do you think it would be necessary to spend?

Doctor TOLMAN. That would depend on the size of the plant, on how much ammonia you wanted to make. If you wanted to change that plant there so as to manufacture about 4 tons of ammonia per day, I think it would cost you something under a million dollars to do it.

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Senator McKINLEY. What does 4 tons of ammonia a day mean in terms of nitrate of ammonia?

Senator LADD. Four tons of ammonia include what amount of ammonium nitrate?

Doctor TOLMAN. One ton of ammonia will make 2.35 tons of ammonium nitrate.

Senator McKINLEY. That plant there now is supposed to make 20,000 tons a year.

Major BURNS. It is supposed to make 30 tons of ammonia per day, and this 4 tons would be approximately one-seventh of the capacity, and 4 tons would be the smallest amount that you could make on a commercial basis. It is nothing more than an experimental quantity.

Senator McKINLEY. It would cost a million dollars?

Doctor TOLMAN. It would cost somewhere around a million dollars to put that plant in shape to make 4 tons—not the original 30 tons it was designed for.

The CHAIRMAN. What would it cost to have it operated at its capacity?

Doctor TOLMAN. Do you mean what would it cost to put that plant in shape to make 30 tons of ammonia?

The CHAIRMAN. Yes; per day.

Doctor TOLMAN. We would have to do quite a lot of figuring before we could answer.

Senator LADD. What is the chief difficulty with that plant?

Doctor TOLMAN. You mean in its present state?

Senator LADD. Yes.

Doctor TOLMAN. I would say that the plant is now successfully developed through the stage of making the water gas, and changing the carbon monoxide in the water gas over to hydrogen. I would say that the purification of the mixture of nitrogen and hydrogen, preparatory to entering the circulating system, could be modified to advantage. When we come down to the circulating system, I would say that the heat interchangers which lead to the catalyst bomb would have to be entirely reconstructed, and the catalyst bomb would have to be a new catalyst bomb. The method of heating that catalyst bomb would also have to be entirely changed, and the method of refrigerating the gases would have to be changed. In making those changes a very considerable amount of the material already there could be utilized, especially if you were making changes to put in only one unit to make in the neighborhood of 4 tons of ammonia.

Senator LADD. The catalyst used at the present time there is not a satisfactory catalyst?

Doctor TOLMAN. These things that I was speaking of have to do with the engineering construction of the plant. Besides the poor engineering, the failure of the plant was due to the fact that they did not have a catalyst that was any good. It was a catalyst which was poisoned permanently by water and did not recover. Their catalyst, when it was fresh, would make somewhere near 7 to 8 per cent of ammonia. I think that we have developed a catalyst at the Fixed Nitrogen Research Laboratory which, under the same conditions, will make over 16 per cent.

Senator LADD. That is not interfered with by the impurities?

Doctor TOLMAN. The 16 per cent ammonia from this catalyst is for the conditions under which the General Chemical Co. catalyst would give 7 to 8 per cent ammonia.

On impure gas their catalyst was permanently destroyed. On gas of the purity that we could reasonably expect to obtain under commercial conditions we would expect our catalyst to do as good as 12 per cent, and do that continuously over a long period of time, making the recharging of the bombs a small matter.

This chart shows another modification of the Haber process. In this process the hydrogen instead of being manufactured from water gas is manufactured electrolytically, giving oxygen as a by-product. From this stage on the process is just the same as when the Haber-Bosch process is used. As you can see, the preparation of the mixture of nitrogen and hydrogen by this process is far simpler than by the other process, and also you get a much purer nitrogen and hydrogen, and do not have any of the difficulties of removing the carbon monoxide, which is a matter of great expense in the Haber-Bosch process.

This modification of the process will, however, take power. It takes much more power than the other modification, namely, 18,000 kilowatt hours per ton

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of nitrogen fixed, as against 4,500 kilowatt hours by the Haber-Bosch process. With power at about 5 mills per kilowatt hour, the cost of manufacturing ammonia by the Haber electrolytic process and Haber-Bosch process is about the same. With cheaper power than 5 mills per kilowatt hours the electrolytic process is cheaper.

The CHAIRMAN. What modification of the plant down there would be necessary to manufacture it according to this process?

Doctor TOLMAN. In order to manufacture according to this process, you would have to put in electrolytic cells for the manufacture of hydrogen. These electrolytic cells, in order to operate economically, would have to be much larger than any now on the market. The nitrate division and the laboratory have had constructed a 10,000-ampere cell and have experimented with it from the point of view of making hydrogen on a large scale, and have found that it is entirely feasible to build a cell of that size.

The CHAIRMAN. Can you give us an idea of the expense of remodeling that plant No. 1 to make it according to this process? We have power there at Muscle Shoals that would be cheap enough to make this practical, have we not?

Doctor TOLMAN. Yes, sir; the figures for the cost of such a reconstruction have been worked out by the nitrate division, and it can give them better than I can. They were worked out on the basis of putting in an experimental unit that would make about 4 tons of ammonia. My memory of the figure was that to remodel this plant and carry out a test on it for making about 4 tons of ammonia, by the Haber electrotytic process, would cost about $1,200,000.

Major BURNS. But that would include operation of the plant for several months in order to make sure the process as developed is working satisfactorily. In other words, we figure if we get the plant constructed, we would have some troubles, and we would have to work them out by operating for a period of about three months.

Senator MCKINLEY. What do you think it would cost to make that a 30-ton plant?

Major BURNS. If you put in the Haber electrolytic process at No. 1, you would have to scrap almost everything you have at No. 1. Nothing there would be of any great value. I imagine putting in a 30-ton unit would cost in the neighborhood of $4,000,000 or $5,000,000.

The CHAIRMAN. You could use your steam plant there, could you not?

Major BURNS. That would not be of much value to you, Senator, because that would be expensive power.

The CHAIRMAN. You don't use any steam, then, outside of power?

Doctor TOLMAN. In this Haber electrolytic process you use about 2 tons of steam per ton of nitrogen fixed in order to purify the water that goes into your electrolytic cell.

Senator LADD. That is a process you have developed in this country, or is this some plant abroad?

Doctor TOLMAN. This particular modification of the Haber process, obtaining the hydrogen by electrolysis, has been in the minds of a great many people. The only place, I think, where it is in commercial operation at the present time is a rather small plant in Italy.

Major BURNS. That is the Casale process that was mentioned several times by one of the witnesses?

The CHAIRMAN. Before you get through tell us about that process.

Doctor TOLMAN. All these processes are modifications of the Haber process. The General Chemical Co. process, the Claude process, the Bosch process, they are all Haber processes with some modification. We don't know precisely what Casale is doing, but from our best information, this is about what Casale is doing. He is getting his nitrogen by putting air and hydrogen together through a burner, and is operating, we think, at pressures of about from 300 to 400 atmospheres.

The CHAIRMAN. What about the patent rights on these various things? What are you people developing here that the Government owns and that somebody else does not have a patent on?

Doctor TOLMAN. With regard to the patent rights for the Haber process, and particularly the Haber-Bosch modification, those patent rights are all held now by the Chemical Foundation, and by taking out, I think, about five licenses, you can do nearly anything you want to, working at pressures between 100 and 300 atmospheres.

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The CHAIRMAN. The Government laboratory has made a great many improvements; it has been working on it a number of years. What about these things that we have developed? Are they using them, and have they gotten patents on developments which you people have made?

Doctor TOLMAN. There are no methods of nitrogen fixation now in operation in this country except the Solvey process plant at Syracuse and the small arc plant up in Seattle. Neither of those is using anything we have developed. The Solvey process people did ask for a license giving them exclusive rights to the use of our catalyst. We said that we believed that a catalyst developed in this way should not be used exclusively by any one concern.

The CHAIRMAN. Is that patented?

Doctor TOLMAN. Patent has been applied for.

The CHAIRMAN. By whom?

Doctor TOLMAN. By the inventor of the catalyst in our laboratory.

The CHAIRMAN. He is a Government employee?

Doctor TOLMAN. He is a Government employee. The patent has been applied for in accordance with the regular War Department regulations, in which the Government retains the right to use the patent itself, and the commercial rights inure to the inventor, and although he has those commercial rights, and they are left with him, nevertheless it is felt that to give a single concern the exclusive right to use that patent would be bad practice.

I may say with regard to the Haber electrolytic process, that there are a number of places in this country at the present time where there is waste electrolytic hydrogen, which is a by-product of oxygen manufacture, caustic manufacture, and bleach manufacture. A great part of that hydrogen is now going to waste. It occurs in amounts sufficient to make from a half ton to six or seven tons of ammonia per day.

We believe that one of the next developments in this country along commercial lines should be utilization of that waste hydrogen in small Haber plants, and a good many people are already interested in that possibility, and it is coming along very fast.

The CHAIRMAN. I want to ask you further about the patent situation: As I understand it, this catalyst has been at least improved by Government employees like yourself?

Doctor TOLMAN. Yes, sir.

The CHAIRMAN. Are those improvements patented by anybody?

Doctor TOLMAN. The improvement on this particular catalyst; yes. Patent has been applied for.

The CHAIRMAN. By a Government employee?

Doctor TOLMAN. Yes, sir.

The CHAIRMAN. So it will come under the regular rule that applies to all Government employees?

Doctor TOLMAN. Well, there is no regular rule. Each department has its own rule.

The CHAIRMAN. Yes; that is true; but it would come under the War Department rule?

Doctor TOLMAN. Yes, sir.

The CHAIRMAN. And that means that the Government can use it itself without paying a royalty?

Doctor TOLMAN. Absolutely; yes.

Senator LADD. How would it be, supposing they would turn the plant over to some party to operate? Would that carry the right to its use?

The CHAIRMAN. No; not as I understand it. Probably you know more about that, Doctor, than I do.

Doctor TOLMAN. I am not enough of a lawyer to say; but the Government can certainly use the catalyst.

The CHAIRMAN. Oh, yes.

Doctor TOLMAN. If they made a Government-owned corporation, which they said was part of the Government, then probably they could use it.

The CHAIRMAN. For instance, referring now particularly to Mr. Ford's proposition by which he would get absolute title to this nitrogen plant down there, the Government would turn it over to him; would he be allowed to use a patent secured by a Government employee without paying a royalty?

Doctor TOLMAN. I should say not.

The CHAIRMAN. That was what I was thinking about. I may be wrong about that, but that is the theory on which the War Department permits its employees to get patents, as I understand it; and it is a fair one, I think, that if they are

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working for the Government and they secure a patent, the Government can use it. If anybody else uses it, even though they sell their product to the Government, they have to pay royalty to the man who owns the patent.

Senator HEFLIN. Mr. Ford's representative here claims that they have got a secret process by which they can make fertilizers for about half the price they sell for commercially.

Doctor TOLMAN. Yes, sir; I have seen such reports in the newspapers.

Senator HEFLIN. That is possible, I guess?

Doctor TOLMAN. If it is possible, I don't know how to do it.

Senator HEFLIN. You are learning something every day about this work that you did not know last year, is not that true?

The CHAIRMAN. We all hope that you or somebody—we prefer you and your other associates in the Government—will eventually get a process that will make it so cheap we can get fertilizer way down.

Doctor TOLMAN. I think fertilizers can be made considerable cheaper than they are being made now, but I could not say, right away, without having tried it, that you can sell fertilizers for one half the present price. It is doubtful. You can sell them somewhat cheaper.

Senator HEFLIN. Don't you think fertilizers can be manufactured at Muscle Shoals with the cheap power we have there and be sold from that place very much cheaper that they are sold to the farmers to-day?

Doctor TOLMAN. Might I postpone, Senator, the answer to that question until I take up what we think ought to be done with the Muscle Shoals plant?

Senator HEFLIN. Very well.

Doctor TOLMAN. I would not want to say no to your question; but when you say "very much" cheaper, I don't know just how much cheaper you mean by "very much," and I should not like to commit myself.

Senator HEFLIN. If it is any cheaper it would help the farmer some, wouldn't it?

Doctor TOLMAN. Certainly. I would now like to try to make a statement comparing these three methods of nitrogen fixation.

The CHAIRMAN. Before you do that I would like to ask you about the Casale process.

Doctor TOLMAN. Yes.

The CHAIRMAN. It has been claimed here that that was a great thing, and a man called on me this morning about it. Just while you are telling us about these processess, tell us all you know about that.

Doctor TOLMAN. As far as we know, the Casale process is a Haber electrolytic process, in which the hydrogen is made by electrolyzing water, using cheap power—cheap Italian water power.

The CHAIRMAN. Similar to that last poscess you have described?

Doctor TOLMAN. Yes, sir.

The CHAIRMAN. Is it patented in this country?

Doctor TOLMAN. They have applied, I think, for two patents, one of them, I believe, is on the burner for preparing the nitrogen and hydrogen mixed by burning air. There is not anything in there that they can patent. Anybody can use that. They operate, I believe, at rather high pressures—probably 300 to 400 atmospheres—although we have not precise information on that point. But there is no particular difference between the Casale process and the Haber electrolytic process.

Since we are talking about all these different methods, I, perhaps, ought to say a word about what is called the Claude process. That, again, is a Haber process, and its only difference is that it operates at very high pressure—in the neighborhood of 1,000 atmosphere—and, as far as we know, it has not gone into commercial operation. It has been tried out on a semiworks scale.

The CHAIRMAN. It is safe to say, for a layman, like myself, that the improvements that have been made in any recent date are all along some modification of the Haber process or practically so?

Doctor TOLMAN. The improvements in nitrogen fixation, you mean?

The CHAIRMAN. Yes.

Doctor TOLMAN. Yes. I would say that the Haber process is the newest of all the methods of nitrogen fixation, and that is the one most susceptible of improvement; and I would say that far more research and far more possibilities of change have been found in the Haber process than in any other method of nitrogen fixation. The arc process is standardized, and also the cyanamide process. The biggest change in the cyanamide process lately has been in going to very large ovens. We understand the ovens at Niagara Falls now are

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bigger than the ones ot Muscle Shoals. I think about three times as large. To try to compare these three main methods of nitrogen fixation, I would say that the arc process required the following conditions:

Very cheap water power——

The CHAIRMAN. When you say "very cheap," if you can, I wish you would use that expression in relation to the power that we are going to have at Muscle Shoals. Is that cheap enough to utilize it for the arc process?

Doctor TOLMAN. One mill power would be cheap enough to use the arc process if the product——

Senator MCKINLEY. The testimony of Colonel Bardon was that it would cost 2½ mills, not counting any investment which they now have, but on the money that is put in.

The CHAIRMAN. Senator, the doctor has not made any claim, as I understand it, that they will produce power at 1 mill.

Senator MCKINLEY. He is just starting out.

Doctor TOLMAN. May I change my testimony so as to make it correct? With water power at 1 mill per kilowatt hour, the arc process would be a good method of fixing nitrogen, if you wanted your nitrogen fixed in the form of nitric acid for use on the spot or in the form of calcium nitrate. If you do not want it in those forms——

The CHAIRMAN. Then, what?

Doctor TOLMAN. Then it is not a good method of fixing nitrogen.

The CHAIRMAN. With any kind of power?

Doctor TOLMAN. Yes. Now, I would like to say something about the cyanamide process. The cyanamide process is, I think, gradually going to be displaced by the Haber process, except under special conditions. These special conditions would be or might be those present at Muscle Shoals, where you have cheap water power, and you already have a plant constructed and a plant which would presumably be fairly capitalized at nowhere near its original cost of construction, but perhaps at its salvage value.

We have figures for the cost of ammonia manufactured by the cyanamide and the Haber processes. Our figures are taken from the report prepared by the Nitrate Division, and maybe they have already been introduced. If they have, I don't care to repeat them.

The CHAIRMAN. Go ahead.

Doctor TOLMAN. With power at Muscle Shoals at 4 mills and the plant capitalized at 60 per cent of its original cost, ammonia would be 11.9 cents per pound, including royalties, interest, depreciation, and sales.

The CHAIRMAN. How does that compare with present prices for fertilizer use?

Doctor TOLMAN. That is ammonia gas. It is not sold in that form for fertilizer material.

The CHAIRMAN. That is the one used for explosives?

Doctor TOLMAN. With power at 2 mills, the cost would be under the same conditions 10.8 cents per pound.

For the Haber process, with a plant constructed at the present time, under American conditions, with power at 5 mills, the cost would come out 11.6 cents per pound of anhydrous ammonia, whether manufactured by the water-gas process or by the electrolytic process.

With power at lower figures, the electrolytic process gets progressively cheaper until, with power at 3 mills per kilowatt hour, your cost of ammonia by the electrolytic process has gone down to 9.7 cents per pound. That again includes interest and depreciation. I do not think it includes sales.

I think that gives an idea of the relative cost of the two methods; but there are many more possibilities of improvement in the Haber process than in the cyanamide process. At the present time the Haber process, for which you have no plant, would manufacture ammonia at about the same cost as the Muscle Shoals plant will manufacture it by the cyanamide process, but in the future I think the cyanamide process will be displaced by the Haber process. I would like now to made a statement in regard to the Muscle Shoals plant, but I don't want to take up your time.

The CHAIRMAN. Go ahead. We want you to.

Senator HEFLIN. You say that if the Muscle Shoals plant No. 2 and the plant No. 1 could be made to function properly, it would not supply us with the necessary nitrates in time of war?

Doctor TOLMAN. Well, I don't know just what you mean by that word "necessary." Do you mean to supplement the other sources of nitrogen?

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Senator HEFLIN. Well, what portion of the supply could we manufacture at Muscle Shoals with the power we have?

Doctor TOLMAN. That is, you mean in war times?

Doctor TOLMAN. I think Major Burns can answer that question better than I can.

Senator HEFLIN. You said something about the American Cynamid Co. of Canada would have to supplement the supply that we would produce at Muscle Shoals.

Doctor TOLMAN. Nitroguanidine is a form of fixed nitrogen that can only be obtained from the cynamid method of nitrogen fixation, and I said that if in the future smokeless powder should contain nitroguanidine as an important constituent, then the capacity of the Muscle Shoals plant would not be enough to manufacture nitrates sufficient to keep 50 divisions in the field.

The CHAIRMAN. That is not used in smokeless powder.

Doctor TOLMAN. It is not used now.

The CHAIRMAN. Would it improve smokeless powder if it were used?

Doctor TOLMAN. I know elaborate experiments are being made in the direction of making nitroguanidine. Can you tell the present state of those experiments, Major Burns?

Major BURNS. The Ordnance Department is always looking for a better propellant, and if thinks there is a possibility of getting a better propellant by use of nitroguanidine, but that is wholly in the experimental stage. We want a powder that will not absorb moisture, so that when the artilleryman throws it around in the field it will not be spoiled, and this nitroguanidine would assist in eliminating moisture. That is one of the big reasons why we are experimenting with it. Of course it is wholly in an uncertain state.

Doctor TOLMAN. I want now to make a statement with regard to the peace-time utilization of United States Nitrate Plant No.2. The present product, which that plant was designed to make, is ammonium nirate, and ammonium nitrate can not be the main peace-time product, because it is not used in the present fertilizer practice in America. So some modifications would have to be made in the plant in order to adapt it for peace-time use.

The most natural product that one would think of would be ammonium sulphate. In order to manufacture ammoniun sulphate at plant No. 2 it would be necessary to set up a sulphuric acid plant, the units of which have already been shipped down there, and make sulphuric acid, and make ammonium sulphate. With ammonium sulphate at its present price of about $50 a ton it would not be possible to operate the Muscle Shoals plant and pay expenses, manufacturing ammonium sulphate as the sole product of the Muscle Shoals plant. That does not mean, however, that therefore the peace-time utilization at the Muscle Shoals plant is impossible. We believe that the Muscle Shoals plant can be remodeled and redesigned to make a variety of nitrogen containing products and be successfully operated commercially, given cheap water power and a low capitalization.

Senator HEFLIN. Yes, sir.

We have prepared here a chart—of course a purely tentative plan—which would show a variety of materials to be manufactured at the Muscle Shoals plant.

Senator MCKINLEY. May I ask, are all those materials for the benefit of the farmer?

Doctor TOLMAN. The larger bulk of the material in tons is for the benefit of the farmer.

Senator MCKINLEY. Seventy-five per cent?

Doctor TOLMAN. Yes, sir. You see, we have here 40,000 tons of nitrogen a year, and the only industry that can use that large quantity per annum is the agricultural industry, so that you have got to get rid of the bulk of your material for fertilizers. Those products we have put down here [showing what is manufactured]—ammonium sulphate, ammonium phosphate, urea, ammonium nitrate, which is now the present product of the plant; double salts and mixed salts, containing both ammonia and potash and having less deliquescence than ammonium nitrate; some cyanamid fertilizer; and a variety of high-grade special organic chemicals for which the cyanamide process is especially adapted.

Senator KENDRICK. Do you mean to say that those are by-products that will be manufactured in addition to 40,000 tons of nitrates?

Doctor TOLMAN. No, sir. The sum of all these materials would contain 40,000 tons of nitrogen.

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The CHAIRMAN. What would it cost to remodel the plant so as to accomplish that result?

Doctor TOLMAN. We have not got to that stage in our calculations as yet. We would not make any statement.

The CHAIRMAN. Does it mean a comparatively large amount of changes?

Doctor TOLMAN. It does not mean expenses anywhere near the original expense of building the plant. I would say that wou could go a long ways in the direction of accomplishing these results with ten to fifteen million dollars.

The CHAIRMAN. Would the plant still be in such condition that you could at once utilize its full capacity for the purpose of making explosives in case of war?

Doctor TOLMAN. Yes, sir.

The CHAIRMAN. You would do nothing in remodeling it in that way to interfere with its being used on short notice for the manufacture of explosives?

Doctor TOLMAN. Short notice would be sufficient.

Senator MCKINLEY. As I gather, you would have about 30,000 tons that you could use for farm fertilization out of the 40,000?

Doctor TOLMAN. I don't want to put it quite so low as 30,000 tons.

Senator MCKINLEY. Thirty-five thousand tons?

Doctor TOLMAN. Perhaps 35,000 tons, although the——

Senator MCKINLEY. How many acres will 35,000 tons fertilize?

Doctor TOLMAN. It depends altogether on how heavy an application of fertilizer you make.

Senator MCKINLEY. Well, use the law of averages.

Doctor TOLMAN. Reasonable practice for a farmer would be to put, say, 15 to 20 pounds of ammonia to the acre. I will figure that out for you.

Senator MCKINLEY. Please figure it out and put it in the record when you revise your testimony.

Doctor TOLMAN. At 20 pounds of ammonia to the acre, which is a reasonably heavy application, 35 000 tons of nitrogen would fertilize 4,250,000 acres.

The CHAIRMAN. The capacity of the plant is 40,000 tons?

Senator MCKINLEY. But the witness says he could not use but 35,000 for fertilizer.

The CHAIRMAN. I understand that.

Doctor TOLMAN. Not all that you can use, but all that it would probably be economical to use. The tonnage that would go into these special chemicals would be very small, but from a money value standpoint the amount would be large.

Senator MCKINLEY. You have made that clear.

The CHAIRMAN. And that would be sold for other purposes in commerce?

Doctor TOLMAN. Yes, sir. These things can all go into fertilizer—all of these [indicating on chart]. There is just a small amount that could not go into fertilizer.

The CHAIRMAN. What would be the sale value of the product that would not go into fertilizer, just in round figures?

Doctor TOLMAN. I could not give you the figure on that. We want to try to make it as big as possible, because it does not absorb much nitrogen but brings in bigger returns.

In order to carry out these modifications you would have to take over part of your carbide furnaces to manufacture phosphoric acid, or you would have to build additional furnaces to manufacture phosphoric acid, and that would give you a product which is going to be very important in the next few years.

To sum up what we have to say in regard to the peace-time utilization of the Muscle Shoals plant, we believe that if the property is correctly handled, with good advice, with good chemists, with water power cheaply provided, and the capitalization not set too high on the plant that is not there, then the plant can be successfully commercially operated in peace time as a real benefit to the farmers for the manufacture of fertilizer.

We have a number of samples there [indicating bottles on table] of special chemicals and fertilizer materials which can be manufactured, and also samples illustrating the cyanamide process.

The CHAIRMAN. To utilize this plant No. 2 do you think it would take ten to fifteen million dollars to remodel it and put it in condition?

Doctor TOLMAN. I make this statement, not on the basis of careful calculation, but I should think that for ten to fifteen million dollars you could do everything that we have indicated on that chart.

The CHAIRMAN. And then in addition to that——

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Doctor TOLMAN. It might not take quite $10,000,000.

The CHAIRMAN. Would you, then, in addition to that back up plant No. 1?

Doctor TOLMAN. I believe if that property is going to be handled right you have got to contemplate gradually going over to the Haber process and taking the carbide furnaces which are now used in the cyanamide process and putting them on phosphoric acid.

The CHAIRMAN. Just as a war propositon, even if we could not get anything in peace time, we would not dare think of withdrawing or scrapping plant No. 2?

Doctor TOLMAN. No, sir.

The CHAIRMAN. Because it will make explosives?

Doctor TOLMAN. Yes, sir.

The CHAIRMAN. And we might need it. So we will have to keep that until such time, if ever such time comes, that the Haber process or some other process is sufficiently developed to take its place. I take it that the Government if it remodeled this plant according to your suggestion, so as to make a plant that could manufacture fertilizer in time of peace, notwithstanding that the Government never ought to quit in its experimenting and its attempts to improve and develop whatever process shows the best indication of improvement, that means that we would have to keep the other process there also, according to your idea; that is, that the greatest possibilities are in the Haber process.

Doctor TOLMAN. Yes. We believe, however, that it would be very wrong to scrap that cyanamide plant, and we believe that some nitrogen in the cyanamide form should always be made, because there are certain things you can do with cyanamide that you can not do with any other form of nitrogen.

Senator HEFLIN. You think both of them could be operated, then, to advantage?

Doctor TOLMAN. Yes, sir.

The CHAIRMAN. Senator McKinley, have you any other questions?

Senator MCKINLEY. I gather from what you say that the amount of farm fertilizer that could be manufactured would be about 4,000,000 to 8,000,000 pounds. Of course, I live in Illinois, where we have good soil and do not need fertilizer, but what is the rest of the country going to do for fertilizer?

The CHAIRMAN. Oh, well, we won't give it to you in Illinois. Illinois can get along without it.

If there are no further questions we will adjourn.

(Whereupon, at 11.30 o'clock a. m., the committee adjourned subject to call of the chairman.)

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MUSCLE SHOALS.

SATURDAY, MAY 20, 1922.

UNITED STATES SENATE,
COMMITTEE ON AGRICULTURE AND FORESTRY,
Washington, D. C.

The committee met, pursuant to call, at 12 o'clock noon, in room 224, Senate Office Building, Senator George W. Norris presiding.

Present: Senators Norris (chairman), McNary, Capper, Keyes, Gooding, Ladd, Norbeck, Harreld, McKinley, Kendrick, and Heflin.

STATEMENT OF MR. THOMAS A. EDISON.

The CHAIRMAN. Mr. Edison is here; and, in an informal way, will you tell us, Mr. Edison, something about Muscle Shoals?

Mr. EDISON. Well, three or four months ago Mr. Ford asked me to go down in his car and look over Muscle Shoals and tell him about the machinery down there for making cyanamide and ammonia by the Haber process. I went down there and went carefully over the plant and found that you have a very fine plant there for making cyanamide, from which you can make fertilizer, or you could make explosives.

Then I went over the Haber plant, and it was not good, but the same people have since put up a similar plant which is successful.

Of course, the Government would have the right, I am sure, to use the perfected process by paying a royalty; so with the two processes you would have a sure thing. The cyanamide process, of course, is not as cheap as the Haber process; but it does not matter when we get in war—a few cents extra per pound would not matter. You don't want much power for the Haber process; therefore, if you put the Haber process up there, you would have an enormous amount of power to sell for manufacturing purposes. If you use the cyanamide process you want a lot of power; if you use the Haber process you don't need much.

I think we have had our belly full of war, and I don't think there will be any more war for five years anyway. I think it is a safe bet. So we have got some time to think. The proposition looks very good. There is more power, I think, there than what the engineers report that can be made available.

We must consider the future. If we have to go to war, and they shoot up the Panama Canal and station cruisers outside of that one port down there where they ship the Chilean saltpeter, and a couple of submarines in the Straits of Magellan, you are done up. You have got nothing to fight with except bluff. You ought to take out an insurance policy somewhere. But you won't have any trouble for four or five years anyway. But some day look out. You have got to have something. The whole thing is right down there. You can shoot it up. I mean Chile. You see, Germany got its saltpeter over there, too, but when she couldn't get any more she started all her chemists—and they are fine chemists—and they got the new process and became independent of Chile.

I asked Mr. Ford if he would made a full fertilizer or only cyanamid. He said, "Full fertilizer." He also said, "Won't you look around a circle of a hundred miles around Muscle Shoals and see what you can count on to help out on the fertilizer?" So I went to Wilbur A. Nelson, of the Tennessee Geological Survey—a fine fellow—and he got me a lot of samples, and the geological survey men in Alabama and Georgia did the same. I have got my place full of those samples and am working out a process for obtaining cheap potash. I

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was quite surprised to find down there at Cartersville, not very far from Muscle Shoals, a slate formation that is many miles wide and many miles long, an angle of about 30, and I guess there is about enough potash there to supply the United States for centuries. Many experimenters have been trying to get potash out of feldspar, of which you have an enormous amount down there in the Smoky Mountains below Asheville, but they have never succeeded in obtaining it cheap enough to meet German prices.

Senator McNARY. What process, if any, are they using to extract the potash in these mountain deposits?

Mr. EDISON. None. They have not been able to do it commercially.

Senator McNARY. I mean, what are your plans?

Mr. EDISON. I can give you generally what it is. Well, I don't think I had better. I might fail. I have never yet eaten any boiled crow—all my stuff has worked—and I don't want to start now. Wait until I get through experimenting.

The CHAIRMAN. Have you experimented enough to satisfy yourself that it is practical?

Mr. EDISON. I can assure you I can get 90 per cent of that potash out, and I believe I can deliver it f. o. b. Savannah now for 65 cents, and the best Fritzie can do is 55 cents. Of course they will beat me out, but I will beat them before I get through with it. That is 55 cents per unit. He can do that because he is hard up, and I don't know how long he is going to be hard up, but he can do that and I can't. I am, I believe, within 10 cents of that, but I believe I will get it much lower. That is at Cartersville, Ga. I want power from Muscle Shoals or some other place. You see, with cheap power I would be able to accomplish the cheapening of the potash.

I am also working on the phosphate. That, with nitrogen, would make a full fertilizer.

The CHAIRMAN. Tell us generally what your idea is about the possibilities of power development at Muscle Shoals?

Mr. EDISON. That is out of my line. I don't know anything about that. I have not been in the power business for many years.

Senator McNARY. I would like to know, of the three processes—the arc, the Haber, and the cyanamid—if you think improvements can still be made and whether you are working on a still different one. I would like to have you discuss that generally?

Mr. EDISON. Oh, the field is unlimited. The Lord knows in 20 years present processes may be obsolete. They may all be dead and buried. It is continuous, continuous—improvements go on forever.

Senator McNARY. The development?

Mr. EDISON. But you have the power. You have that dam, and you have that power, and it doesn't make any difference; you would just earn enough out of the machinery that you could afford to scrap it.

Mr. McNARY. Do you think you have a process which would be an improvement on any one of those three?

Mr. EDISON. No, sir. I have never worked on any. When they first started the war—of course, I am really a chemist more than anything else, although I have been in every line of business. I have been for 50 years in business, and I have never had in 40 years less than four or five thousand men working for me. Of course, I know all the collateral things. I have been through the mill.

The CHAIRMAN. If there is anything further that you can say about this process we will be very much interested in hearing it.

Mr. EDISON. Well, I think those processes will work out so that the full fertilizer, in the course of a few years, will be extremely cheap, and you certainly will get more bales of cotton. What I saw down there in those poor little starved places near those falls is awful. Cotton about that high [indicating]. I got off and looked at it. That land is all right. It wants fertilizer, and it has got to be awfully cheap.

I have been trying something so as to let the farmer make a part of his own fertilizer. I believe that will come, so he will not have to pay any freight. The freight charges are a holy terror—awful. I am sure you can double your bales of cotton per acre, whatever it is. I guess you get about a half bale now, don't you?

Senator HEFLIN. Much less than that.

Mr. EDISON. Well, all you need is fertilizer.

Senator HARRELD. Can you say anything more about your own process to let the farmer make his own fertilizer?

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Mr. EDISON. No. I am not far enough along with it. But I will say I believe it is a coming thing that he can make a fertilizer, but a certain part of that fertilizer he must buy.

Senator HEFLIN. Do you think cheap fertilizer can be produced at Muscle Shoals?

Mr. EDISON. There is one I found out. If you take these Tennessee phosphates and grind them fine enough and your land is sour, you have all the phosphoric you want.

Senator HEFLIN. Do you think that cheap fertilizers can be made at Muscle Shoals?

Mr. EDISON. Yes; I think it can be done very cheap.

The CHAIRMAN. If you have anything else to say we will be glad to hear anything else you have to say.

Senator MCKINLEY. About anything.

Mr. EDISON. I would like to say something else. Mr. Ford says to me, "Why can't we put this money in Muscle Shoals and issue currency against it? It is good security." It looked all right, as a great many things do, on its face. So I tried to work out whether it would be all right, and I have been at that in addition to these other things. I have been trying to make that thing work. It don't go. Although there is plenty of security behind that money, it won't work. I am very disappointed. Well, I will tell you, you can't make it gibe in with what we have. The only way is to issue bonds and create a sinking fund. That is the only way I can see.

Mr. MEADOWCROFT (assistant to Mr. Edison). You understand what he means—it does not gibe in with the other matter which you discussed night before last.

The CHAIRMAN. The committee is very much obliged to you.

Senator HEFLIN. You don't think you would like to express any opinion about the various offers?

Mr. EDISON. I don't know about them.

Senator CAPPER. There are several offers before the committee for consideration by the committee, including Mr. Ford's offer. The Senator was asking whether you would care to say anything on that subject?

Mr. EDISON. Well, I don't know anything. I can't say anything. I never worked in that line. I was just down in a narrow, technical way. I have not been working along that line.

Senator HEFLIN. You don't know the details of Mr. Ford's offer, and, of course, you don't know the others?

Mr. EDISON. No. I don't attend to his business.

Senator HEFLIN. You know that Mr. Ford wants to get Muscle Shoals?

Mr. EDISON. Yes. He seems to want it. I don't know why. He has got enough work now. I think he would be very foolish. His wife thinks so, too. He has got $127,000,000, he told me, subject to check. Now, what the devil does he want of any more money? I am sure he don't. He wants to help the farmer.

Senator HEFLIN. Do you think Ford can manufacture cheap fertilizer at Muscle Shoals?

Mr. EDISON. Oh, well, he would put up all kinds of factories for making everything. There is no end to him.

Senator HEFLIN. He would build a great industrial city down there? Do you think it would probably grow into a large industrial section down there?

Mr. EDISON. Yes; I think so. You will have more manufacturing in the South.

I was reading over all this testimony about the farmers. I think the trouble down South is that they don't have diversified farming. Now, I am in business, and long before the war I was doing about $30,000,000 worth of business, and I had about 5,000 men; but I have been in lots of businesses before, so I am not stuck on one kind of business, so I got by; and when these things came along and it loomed up, of course, the wages went up, and I had to go to work and keep my wages down. Of course, I paid the men their wages, but I put in automatic machinery to neutralize the extra wages I was paying them. So my total wages did not rise. That is, the wages on anything I made did not rise. They kept raising wages more and more, and I had to work night and day and put in automatic stuff to get rid of a lot of them. So my pay roll is no more per man to-day than it was in 1914. Although the men get more money, it is just as cheap to me. Now, one of my businesses is in the soup. It has all gone to pieces, and my competitors—I don't know, but I

think about 50 of them have gone broke or bent, a lot of them in the hands of receivers, and then there is a lot of them that are run around by the back door. They are run by a lot of bankers trying to get their money out of them. If I had had only that one thing I would have been in a bad condition, but I have got two of them that are booming and another one that is pretty good, so I am on velvet. My pay roll is no more than what it was before the war; and their trouble is that they have not got an automatic machine designer, therefore they can not do what I could do. I don't care what the pay roll is, I could neutralize it every time by making up more automatic machinery. About two years ago I made two machines and saved $186,000 on my pay roll a year.

Senator HARRELD. I was wondering whether you could teach Uncle Sam to do some neutralizing?

Mr. EDISON. I was thinking that the Government should organize a school for teaching automatic machine designing.

The CHAIRMAN. That is very good.

Mr. EDISON. The trouble is that you may have 500 draftsmen and you will not find more than one fellow in the bunch that has got imagination. Make that fellow a machine designer and before he dies he will create at least $50,000,000. But they are awful scarce. I get men all the time. I got out a questionnaire and set for college students and was awfully disappointed at the results. I guess we had 2,000, and I think I hired about 70 of them, and only one man has got any imagination. The others didn't have any. I had one applicant day before yesterday who had never heard that McKinley, Lincoln, or Garfield were assassinated. He didn't know they were assassinated, and he had been four years in college. Well, you know I sift them out, and they are doing reasonably well.

I have been working along the line of solving the problem of cheap distribution in merchandising of goods in the city. Perhaps you know that the expense of getting from the manufacturer or the farmer to the consumer is awful, so this will help. The cost of delivery is what I am working on. It is done by electric automobiles in place of gas, because the electric automobile will last, on an average, about 15 years, and the gas car, in that kind of work, does not last more than four years, and then the repairs and everything are excessive. That causes the cost of each delivery to run way up. But the electric is very low, and it only has one moving part, whereas the gas car has 250, and they reciprocate and pound themselves to pieces, and then you have to have experts.

The Ward Baking Co. started the ball rolling by the milk and bread delivery, and so they went in and made their own automobiles, and then so many milk people and other people have these deliveries where the life of the trade is the small cost of delivery. Now, they are spreading all over and my factory is booming, and I have the only thing they can use. That is going to help all over.

The CHAIRMAN. What, in your judgment, are the possibilities of the development of the storage battery so that it can be used in all kinds of transportation?

Mr. EDISON. Well, for city deliveries, the terrible cost comes in in delivering from the farmer to the consumer (the man who eats the stuff), it is at present too expensive. I think we can cut it in two.

The CHAIRMAN. For long distances, such as railroad and street car transportation.

Mr. EDISON. I have never studied it.

The CHAIRMAN. I want to know what are the possibilities of improvement of storage batteries, and whether it is possible that it may be carried into long distance transportation. I want to know whether such a thing is practical or not.

Mr. EDISON. No; it is for city delivery.

Senator MCNARY. Is it not true that the excessive weight of the batteries is one of the handicaps of the business.

Mr. EDISON. Twenty miles each way, total 40 miles. That is the limit of the storage battery, commercially speaking. If you want to go farther you have to have the gas machinery.

The CHAIRMAN. Do you think the inventive genius will bring about an extension of that?

Mr. EDISON. Oh, yes. We don't know anything about that. It is bound to come.

Senator MCNARY. The weight is one of its handicaps?

Mr. MEADOWCROFT. The matter of weight is met by his particular battery, because he gives over twice as much for the same weight as the lead storage battery.

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The CHAIRMAN. Tell us something about cement. You started to speak of that a while ago.

Mr. EDISON. Well, I have a cement works, and the whole crowd of cement manufacturers have been competing and cutting each other's throats, and one or two of them have made 5 per cent, because they got a special kind of stuff, and now we are being sued under the Sherman law. I said it didn't amount to anything, because if a lot of people are together and they have never made a dollar, that is prima facie evidence that there is not a combination; but Mr. Daugherty thinks there is, and so he sued us.

Senator HARRELD. A combination, then, is all right so long as they don't make a profit? The question of tariff on cement is being debated over in the Senate to-day.

Mr. EDISON. The tariff business—look out. It's poison.

Senator HEFLIN. How far are those potash beds that you spoke of from Muscle Shoals?

Mr. EDISON. I was looking for the scale of that map over there on the wall. I don't see it. I guess it is only about 80 to 125 miles. You can run a wire over there.

The CHAIRMAN. That is all, unless you have something further to say, Mr. Edison.

Mr. EDISON. I worked in Washington during the war. I got pretty familiar with what was being done, and I was told not to say anything to Congressmen. That looked rather fishy, and I found out after a while that a lot of those fellows that were running the details of this Government were false; they were not the real thing; they were counterfeits. I am surprised that you don't draw your bills differently. Draw up a skeleton of your bill and specify the initial thing you have to do, and when that is done you will find out what the first step costs. Now, go ahead and continue it on by supplement, so you will know the progress of all your legislation and make them show up in between each supplement. You would have saved five or six billion dollars here and you would not have got a lot of these inefficient people. It comes in sections and each time they come for more money you make an amendment to the act. Let them have it, but they have to show up. Under the war administration nobody had to show up. You will have it showed up by and by. I am sure you use wrong methods. You should always pass a bill that contains just the rudiments of the entire bill; then you have to have the first start, the instrumentalities you start with to make that thing function, and spend several million dollars. When you have got through the first stage let them come to Congress and get the additional legislation to go ahead a little further, and when you have gotten through an examination of what has been done you will know if there is anything rotten in that, because you will see how all the money has been spent. But the way you do it now you make the bill and quit and never hear anything, and you try to get some information and you don't get any at all. They double-cross you all the time.

Senator HARRELD. You are right about that. You want to make legislation a progressive science?

Mr. EDISON. It is not dishonesty; it is inefficiency.

The CHAIRMAN. We appreciate your presence, Mr. Edison, and are very much obliged to you.

(Whereupon, at 12.45 o'clock p. m., the committee adjourned until 10.30 o'clock a. m. Monday, May 22, 1922.)

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MUSCLE SHOALS.

MONDAY, MAY 22, 1922.

UNITED STATES SENATE,
COMMITTEE ON AGRICULTURE AND FORESTRY,
Washington, D. C.

The committee met, pursuant to adjournment, at 10.30 o'clock a. m., in room 224, Senate Office Building, Senator George W. Norris presiding.

Present: Senators Norris (chairman), Capper, Ladd, Norbeck, Kendrick, Harrison, and Heflin.

STATEMENT OF MR. HUGH L. COOPER, CONSULTING ENGINEER, STAMFORD, CONN.

The CHAIRMAN. First give your name and occupation to the stenographer for the record.

Mr. COOPER. My name is Hugh L. Cooper; I live at Stamford, Conn.; and I am a consulting engineer, specializing in the building of hydroelectric power plants.

The CHAIRMAN. Give the committee, just briefly, a short history of your life work—where you were educated, first, and what your connection has been with the development of various water powers.

Mr. COOPER. I have had no college education. I am a graduate of an ordinary Minnesota country high school. I went to work as a common laborer thereafter, and what little I know has been gathered by night study and day practice.

The CHAIRMAN. That ought to make you a very valuable witness here.

Mr. COOPER. I began 30 years ago in the building of dams, when the hydroelectric industry was in its infancy, and since that time I have been building various power plants in different parts of the world, totaling something over a million horsepower of plants that have either been designed by me and constructed by me or designed and partially construced by me. Among these plants are one in Brazil, amounting to 40,000 horsepower; one in Chile, amounting to 34,000 horsepower; one in Canada, at Winnipeg, 40,000 horsepower; Niagara Falls, Canada, 150,000 horsepower; McCalls Ferry, Pa., 125,000 horsepower; the Mississippi River, at Keokuk, Iowa, 200,000 horsepower; and various other plants, filling in the residue of a million horsepower. I have built 12 or 14 dams and have been consulting engineer on a good many other plants that I have not built.

Mr. COOPER. Fifty-seven.

The CHAIRMAN. Now, Mr. Cooper, you know, of course, what we are considering, and we would be glad to have you, in your own way, tell us what you know about it. Give us your opinion in regard to the various questions connected with the development of power at Muscle Shoals.

Mr. COOPER. Will you depend, Senator, on the House record as to just what my relations with the job have been, or shall I tell it to this committee?

The CHAIRMAN. You had better tell it to this committee.

Mr. COOPER. When I was in the service in France I was ordered home by the Secretary of War in the beginning of 1918 to build what is called Wilson Dam at Muscle Shoals. I remained on the work at this dam about two months, when General Pershing ordered me to return to France for port work. After the war was over and some three or four millions had been spent on the work the present Chief of Engineers asked me to take over the design of the work and the inspection thereof, principally because the plans they were following were plans that I had made when I was in the service, and those plans were radically different from the original plans that had been prepared by the Army engineers for this undertaking. After some consultation with the Chief of Engineers I could see the embarrassment that he was in because of the carrying

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out of specific plans that another man had made, and because of their being so radically different from the original plans, and I also saw my own embarrassment in going on with the work on the question of a fee. My own fees are, in private practice, very much larger than any government pays. I have two schedules of fees in private practice, one of which schedules is a per diem of $250 a day and expenses, together with a charge for all the labor that is employed by me in the engineering work, plus 60 per cent on the cost of that labor for overhead, plus a charge of 25 per cent for a profit. That is the minimum fee I receive for work in private practice. The maximum fees vary from 4 to 6 per cent of the total cost of the work, out of which I pay all of the engineering expenses and cost of purely engineering work.

In order to not embarrass the Chief of Engineers I told him that I would make the charge the lesser of these two systems of charge, except that in the case of the Government I would not charge any profit; I would stop at 60 per cent overhead. Realizing that anybody who attempts to have any contractual relationship with any government is apt to find himself annoyed by such a contract, I put in the contract that either party could cancel the contract on 30 days' notice, and that stipulation is still in the contract.

Recently various statements have been made to the effect that there was some doubt as to the integrity about the statement of no profit and that I was making a great profit and all that sort of thing. I hereupon asked the Chief of Engineers to have my books audited and discover whether I was actually truthful when I told him what my charges were. As a result of that request the Chief of Engineers has had the accounts audited of several jobs, one, amongst others, of a foreign government, and the result of that audit is shown on photostat copies of correspondence between Col. Edw. Burr, district engineer, New York City, who made the investigation, and the Chief of Engineers, and I will be very glad to leave a photostat copy of this correspondence for this record if you wish it.

The CHAIRMAN. All right. We will be glad to have it in the record.

(The correspondence referred to is as follows:)

WAR DEPARTMENT,
UNITED STATES ENGINEER OFFICE.
New York, N. Y., April 29, 1922.

Misc. 638/54
From: The District Engineer, First District, New York City, N. Y.
To: Chief of Engineers, U. S. Army.
Subject: Wilson Dam.

1. In accordance with instructions received April 28th over the telephone from Brig. Gen. Harry Taylor, Assistant Chief of Engineers, I have caused an examination to be made of the accounts and records of Hugh L. Cooper & Co., consulting engineers, No. 101 Park Avenue, New York City, N. Y., with respect to the charges made by them for engineering services rendered in connection with the Wilson Dam at Florence, Ala., under their contract made with the Chief of Engineers, U. S. Army, for the rendition of such services.

2. This examination in detail was made by Mr. Jos. S. Beran, clerk accountant in charge of the finance subsection of this office. Mr. Beran is an experienced accountant and I have every confidence in his capacity and reliability, nevertheless, in view of the circumstances under which this examination was directed, I have caused him to submit the results of his examination in the form of an affidavit for better verification of the facts desired. The said affidavit is transmitted herewith.

3. Messrs. Hugh L. Cooper & Co. placed at Mr. Beran's disposal all records in their office necessary for the purpose of his examination. The said records were sufficient to verify fully the facts reported by Mr. Beran to the effect that Hugh L. Cooper & Co. have not made any charges against the United States for services in connection with the Wilson Dam other than as provided in their contract above mentioned and that they have not included in the said charges against the United States any profits such as it is their custom, and the custom of other consulting engineers, to charge for similar services rendered to other parties, nor has any charge been made by Hugh L. Cooper & Co. for the services performed by Mr. Hugh L. Cooper or any of his designated representatives as is customary by the Hugh L. Cooper & Co. to charge other private corporations, enterprises, etc., on the basis of $250 per day, or on any other basis except that of reimbursement of actual traveling expenses at the rate of $40 per day.

EDW. BURR,
Colonel, Corps of Engineers.

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STATE OF NEW YORK,
County of New York, ss:

Personally appeared before me, the undersigned, a notary public in and for said county and State, Joseph Stanley Beran, of Bogota, 9 Ridgefield Avenue, County of Bergen, State of New Jersey, who, after being duly sworn, deposes and says as follows:

In accordance with instructions given me by Col. Edw. Burr, I visited the office of Hugh L. Cooper & Co., 101 Park Avenue, New York City, on April 28, 1922, for the sole purpose of inspecting and verifying certain matters of facts relative to this corporation's charges to the United States Government for services rendered in connection with the so-called "Wilson Dam project," as compared with their charges to other private enterprises or projects for rendering similar services. For this purpose the Hugh L. Cooper & Co. gave me full and free access to their books, records, and files.

A copy of the contract between the United States Government and the above-mentioned corporation dated October 1, 1920, covering the rendition by this corporation to the United States of the above-stated services, was shown me; Mr. Hugh L. Cooper and Mr. R. D. Edsell, both members of this corporation assured me that said copy was a true copy of the original contract; this said copy bore original signature of an officer of the United States which is known to me and which satisfied me of the genuineness of this copy of contract. This copy of contract was given my careful perusal and scrutiny.

Further, carbon copies of all bills submitted the United States Government for services rendered under said contract were shown to me. Assurance was given me by the two members of said corporation, as above mentioned, that these carbon copies were exact duplicates of the original bills as submitted the United States Government. Verification of the genuineness of these carbon copies of bills and the satisfaction, acceptance, and payment in full by the United States Government of these bills was made by me by recourse to the proper entries of the amounts of these bills in all books, records, and bank statements. These bills were in full detail and were entirely in accord with the terms of said contract. These bills bore charges only for the payments of salary to assistants, as defined by said contract, plus an overhead charge of 60 per cent thereof, plus reimbursement of traveling expenses of said assistants and expenditures for purchase of certain materials and supplies, plus traveling expenses incurred by Mr. Hugh L. Cooper or representatives designated by him for special examinataions or conferences at the Wilson Dam site, at Washington, D. C., or elsewhere (which happened to be certain members of said corporation) at the rate of $40 per day only when so actually engaged. No other charges, either for profit or otherwise, were included in said bills.

Further, carbon copies of bills as submitted to three private corporations or enterprises (one a foreign government) were shown me. These three private corporations or enterprises are the only active accounts at this time of Hugh L. Cooper & Co., as indicated by their books and records and as assured me by the two members of this corporation above mentioned. Assurances were given me that these carbon copies were exact duplicates of the original bills as submitted to these three private corporations. The genuineness of these carbon copies and the satisfaction, acceptance, and payment in full of said bills, was verified by me by recourse to the proper entries of the amounts of same in all books, records, bank statements, and deposit slips. Some of the bills antedated the contract hereinbefore first mentioned. The bills are in full detail and show that the charges of Hugh L. Cooper & Co. for services performed were as follows:

A charge of $250 per day for services rendered by Mr. Hugh L. Cooper on days when so actually engaged.

Full reimbursement of payments of salary of all assistants and employees so engaged, plus an overhead charge of 60 per cent, plus 25 per cent of the total of such said payments of salaries of assistants, etc., plus the 60 per cent overhead.

Full reimbursement of traveling expenses of all individuals so engaged, plus expenditures for purchase of materials, supplies, etc.

The accounts of Hugh L. Cooper are periodically examined and audited by The Audit Co. of New York, and a full statement rendered by The Audit Co. of New York, of recent date, was shown me.

I have been reasonably satisfied that Hugh L. Cooper & Co. have charged the United States Government for services rendered only on the basis of actual

cost to them in accordance with all the terms of the contract between them and the United States Government; that said actual cost to them were payments of salaries to assistants and employees (as defined by said contract), plus the usual and common charges of 60 per cent for overhead, plus the actual traveling expenses of such assistants and employees and reimbursement of actual payment for purchases of materials, supplies, etc., and the payment of actual traveling expenses, at the rate of $40 per day, incurred by Mr. Hugh L. Cooper or his designated representative. That no charges were made for profit, either on the basis of their customary charge of 25 per cent to all other private corporations, enterprises, or projects, or in any other wise; also that no charges were made for services performed by Mr. Hugh L. Cooper or any of his designated representatives as is customary by the Hugh L. Cooper & Co. to charge other private corporations, enterprises, etc., on the basis of $250 per day, or on any other basis except that of reimbursement of actual traveling expenses at the rate of $40 per day.

(Signed) JOSEPH STANLEY BERAN.

Sworn to and subscribed before me this 29th day of April, 1922.

(Signed) GEORGE G——— (undecipherable).

Mr. COOPER. So much for my contractual relations with the Government.

Senator CAPPER. May I ask if you have settled with the Government for your services, yet?

Mr. COOPER. I am settled with every 30 days. I submit an account to the Government which is audited by the Government every 30 days, and they pay it.

There has been some little feeling on this work from time to time as between Government engineers and private engineers, and some of this feeing may or may not be well founded, but in view of my belief that the building of this dam is an exceedingly difficult engineering undertaking, I have had to make insistencies in supporting my own judgment with respect to the character of the foundations and design of the structures that would be placed thereon that may be considered ultraconservative. Before I am through testifying this morning I am going to make what I hope will be considered at least a practical and unselfish suggestion with respect not only to my service with the Government, but what I think the Government ought to do with Muscle Shoals at this juncture. My own ideas as to what ought to be done at Muscle Shoals are different, I think, so far as I know, from anyone's ideas that have been before you, and they are not very long, and I want to tell you of them, if I may, a little later.

Before dismissing this subject of the difficulties at Muscle Shoals, I want to briefly state that the difficulties of an engineering kind at Muscle Shoals relate almost entirely to unsatisfactory foundations, by which I mean that it is difficult to make them safe, but it is entirely practical to make them absolutely safe. Because they are a limestone as opposed to granite, they require much more experienced handling. I think also the committee should understand that the Muscle Shoals Dam, when it is finished, will be the largest and most ambitious attempt at an overfall dam in the history of dam engineering in the whole world. The quantity of water that will flow over the top of the Muscle Shoals dams will be three times the maximum discharge of the Niagara River, and when we couple this fact with the fact that this dam is not founded on an igneous rock like granite but on a stratified rock foundation, containing specific and known seams or interstices below foundation lines, you come immediately to discover that you have not an ordinary problem, but an extraordinary problem. With that statement I will pass on to something else, unless you want to cross-examine me or ask some questions.

Senator KENDRICK. I want to ask you, Colonel, what, in your opinion, will be the effect of this structure in that stratified form? Will it not tend to close up the seams?

Mr. COOPER. It will, unless we properly fill them.

Senator KENDRICK. Unless they are filled. My idea was that perhaps the very weight—increased weight—on that formation would have a tendency to seal up any crevices?

Mr. COOPER. The interstices vary so much in thickness that, unless they were properly filled, you would have settlements that would crack your dam and you would lose it. These interstices are not small, but they vary up to 4 inches in thickness in some places, and up to a foot in others, and it would be absolutely impossible to contemplate the founding of a dam on such a set of strata until you knew that you had previously filled these interstices so that the strata could not come together or slide on one another.

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Senator KENDRICK. Is it your opinion that the borings already made would not have revealed crevices?

Mr. COOPER. They only partially revealed them. They never do fully reveal them.

Senator KENDRICK. Your contention is that the crevices might be perpendicular, and the borings being perpendicular——

Mr. COOPER. Might miss it.

Senator KENDRICK. Yes; might miss it.

Mr. COOPER. That is true in some cases.

The CHAIRMAN. I don't want to interfere with the outline which you expect to pursue in giving your testimony, but unless later on you do expect to go into that, I would like to have you go into it now or, at least, at some time during your testimony. In other words, the committee are exceedingly anxious to know whether, in your judgment as an expert, there have been any mistakes made there as to the foundation and whether there are any being made. We don't want to take any chances, of course, of that dam going out, or some accident happening to it. We want to know whether or not the work is being properly done and has been properly done so far.

Mr. COOPER. It is my opinion that the work has been properly done so far and that an absolutely safe structure can be completed there; but I am going to suggest to you to-day that because of the importance of the stability of that structure you should have another independent expert, or a number of experts, come in on this work and see whether Cooper is right or wrong in their opinion. It is too important to be placing all the confidence on one man.

The CHAIRMAN. Well, have you been in harmony with other engineers—the Government engineers, for instance—as to the preliminary work done in securing a foundation for the dam?

Mr. COOPER. Well, I was not in harmony with Col. Lytle Brown. I was very much in disharmony with him about foundations and everything else; but since he was transferred there has not been anybody to have any disharmony with. As a matter of practical fact, I am the chief engineer of this work, reporting to General Beach, the Chief of Engineers.

The CHAIRMAN. You have advisers, of course, and the Government engineers are working with you.

Mr. COOPER. No. I represent the Chief of Engineers. There is no other engineering responsibility down there except mine.

The CHAIRMAN. For instance, in what capacity is Colonel Barden?

Mr. COOPER. His responsibility relates solely to construction and finance, comparable to that of a contractor.

Senator KENDRICK. Supervising construction?

Mr. COOPER. He is the constructor.

The CHAIRMAN. I take it you are the supervisor?

Mr. COOPER. I am the supervisor. I have to pass upon the quality of the work Colonel Barden does.

Senator KENDRICK. I assume that Colonel Barden is not on the job under contract. That is not what you mean by a contractor?

Mr. COOPER. No, no; but he performs the duties of the work that a contractor would do. I am the supervisor. I represent the Chief of Engineers, General Beach. General Taylor is actually in command.

Senator KENDRICK. How far down have you gone in finding a solid foundation? In a great part of the dam is the foundation level across the river?

Mr. COOPER. The strata dips north and south somewhat but the character of the rock in the strata is very satisfactory. The difficulties are thos inherent because of the interstices between the strata, and the resulting need to make sure that these interstices are filled. I have established a system that I am sure will take care of all of that, but when you come to realize what would happen to the community down there and to the Government and the people and to property, as to whether or no what I have provided for is sufficient, I think that the recommendations I am going to make later should be carried out and that all my work should be investigated to make sure.

The CHAIRMAN. Would it be a practical proposition now in parts of the dam, for instance, the one part that has been practically completed, and is it so that you could rectify it in case the investigation would develop that there was something wrong with it?

Mr. COOPER. Yes, sir. That is what I contend. I am sure that if somebody else comes along and proves to the Government that I have been remiss I have not gone so far but what my remissness can be corrected.

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Senator KENDRICK. Right there, Colonel, I want to ask you this question. With such diligence as you no doubt have brought to bear on the situation, and with such judgment as you have, which is probably mature, is it likely that any investigation such as a board of experts would pursue would determine any fault in your conclusions?

Mr. COOPER. I am sure my plans will be approved.

Senator KENDRICK. Assuming that they are, even so, is it not more than likely that your fault would occur in the structure underneath this dam in places and in ways that could not be found on the surface, except by the square test of pressure of this water?

Mr. COOPER. Faults such as you mention would show up in the records and be discoverable from the inspection gallery in the dam. Were you in it?

Senator KENDRICK. No; I was not in the gallery.

The CHAIRMAN. Not inside of the dam.

Mr. COOPER. Did you see that big tunnel in the dam?

The CHAIRMAN. No.

Mr. COOPER. Somebody ought to have shown it to you; perhaps it was under water.

Senator KENDRICK. Yes; I would like to have seen it.

Mr. COOPER. There is a huge tunnel in the middle of that dam, which we call an inspection and observation tunnel, from which all of the questions that you have brought up can again be determined at any time.

Senator KENDRICK. Now, Colonel, here was the idea that occurred to me about it. Suppose that there was a fault in the structure on which the dam rested, would it now be possible for that fault to run true from a point so far above the dam that you would never come in contact with it and still go clear under the structure?

Mr. COOPER. No. I see your point, and the answer to your question is this, that by the use of this observation tunnel and grout pipes that we put therein, we can seal all of these crevices not only immediately underneath the dam but for some distances up and down stream, and make them hermetically tight so that we do not care what the faults are above the dam. Do I make myself plain?

Senator KENDRICK. Yes.

Mr. COOPER. And we can prove by practical air pressure tests that we have succeeded.

Senator KENDRICK. The only thing in that, it seems to me—and if the chairman objects to prolonging this controversy I would like to have him say so——

The CHAIRMAN. No, no, Senator. That is perfectly proper. Go ahead.

Senator KENDRICK. The only thing, then, that would be involved in determining absolutely as to the reliability of that whole scheme, the dependability of it, and the solidity of the structure, would be overcome, as I understand it, as I believe, in going down in different places far enough to leave no doubt of it.

Mr. COOPER. We do that.

Senator KENDRICK. And not necessarily with a drill. It seems to me if it were found necessary it might be best to put pits down in that structure which would determine beyond a shadow of doubt. hTe drill might not disclose a narrow seam that would prove fatal.

The CHAIRMAN. Colonel, I think what Senator Kendrick is getting at is would it not be possible, say up above the dam, say half a mile above, that there would be a hole go down in the rock and go underneath and go under the entire structure and come up again below the dam?

Senator KENDRICK. No; that would not be the idea.

The CHAIRMAN. Is not that your idea?

Senator KENDRICK. No. My idea was if you penetrated below your supposed solid structure far enough you would undoubtedly disclose the presence of this seam if it were there, and that would indicate the danger so that it might be overcome and stopped; but if you depend altogether on drill holes the drill holes might not tell the story, as the Colonel has already indicated.

Mr. COOPER. Let me tell you why they do tell the story. We put down a test hole in any one given place, and we test that hole by forcing water or air to travel through the interstices to a second open test hole 20 feet away. We are putting down holes there every 20 feet, and when we test one hole we test it through being able to get reactions through the neighboring holes. We fill the interstices with grout or liquid cement under air pressure until the tests show that air or water can not be made to travel through the interstices until the test holes hold their pressure.

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Senator KENDRICK. Yes.

Mr. COOPER. And we cover the entire area, and I do not believe that a more careful set of tests was ever carried out than we are carrying out now.

Senator KENDRICK. Now, just one question more, Colonel: What depth below, we will say, the bottom of the river?

Mr. COOPER. Forty feet, and an occasional hole 100 feet.

Senator KENDRICK. What is the——

Mr. COOPER. Diameter?

Senator KENDRICK. No; I was going to ask what is the structure from the bottom of the river down? Practically rock?

Mr. COOPER. All solid rock.

Senator KENDRICK. It is? You go into that solid rock 40 feet?

Mr. COOPER. Yes, sir; with our explorations.

The CHAIRMAN. For fear I might forget it—it does not bear directly on the Wilson dam, but it does on the other one—I understand that the borings for Dam No. 3 have been completed?

Mr. COOPER. Yes, sir.

The CHAIRMAN. And they have been put down in the same way?

Mr. COOPER. Yes.

The CHAIRMAN. So that that location selected now, although no work has been done except the borings at Dam No. 3, the location there has been tested clear through?

Mr. COOPER. I understand so. I do not have any knowledge of my own about Dam No. 3 that is worth the consideration of this committee.

Senator KENDRICK. The plat that was shown us, Mr. Chairman, on the ground, indicated a double row of drill holes clear across the river.

The CHAIRMAN. Yes.

Mr. COOPER. Is that all on the engineering side that you think of?

The CHAIRMAN. Yes.

Mr. COOPER. Now, on the question of the proposals that are before the committee, I have taken the position heretofore and would like to retain that position, if it is agreeable to the committee, that I am not asked to recommend anybody's proposal. I do not want to be in the position, as long as I am the Government engineer here, of recommending anybody's bid for the Muscle Shoals property. I am perfectly willing to go the limit in telling you the faults, as I see them, in anybody's and everybody's proposal, but I do not want to be in the position of an advocate of anybody's proposal.

Senator KENDRICK. That is a perfectly consistent attitude.

Mr. COOPER. With reference to Mr. Ford's proposal, which is the only one I have studied—and I have not read any of the other proposals, and know nothing about them—I have come very reluctantly and regretfully to the conclusion in my own mind, based on 30 years' experience in the business and the engineering side of hydroelectric work, that Mr. Ford's proposal in its present form is a very bad thing from the public-interest standpoint and that it should never be adopted or accepted by the Government of the United States. It is the most extraordinary attempt at what I would call a raid on the Treasury that has ever come to my attention. As a matter of fact, it boils down to just this, that Mr. Ford, who is presumably one of the richest men in the world, is trying to borrow over $80,000,000 at 2½ per cent interest from the Treasury of the United States, and with the money so borrowed he secures the uncontrolled use of the greatest water power the South has for 100 years, and I do not see any justification for it. It is my opinion that any disposal of the Muscle Shoals property should be limited as to its term certainly not to exceed 50 years, and it is my further opinion that the entire water power down there should be subject to official regulation under the terms prescribed by existing Federal law. These two dams create the greatest water power that the South has, and as a natural resource it is much greater than anything else they have, and because of the magnitude of these two dams this power has a tremendous bearing upon the peace and happiness and comfort and prosperity of millions of present and future people, and the proposal to hand out this great opportunity to an unregulated private individual and his heirs for 100 years and loaning money at 2½ per cent interest to harness this resource is most astounding to me.

Now, I know that this committee is anxious for facts. I have been coming before committees of Congress for 10 years, and the one impression I have always taken away with me is that every committee was really trying to get at the facts. I have never left a congressional investigation with any other

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idea. But the difficulty you find is in telling the difference between the wheat and the chaff. Most of the facts you get are either not so, or are twisted around in a way that you can not tell just exactly what they do mean. I think in a question that is so highly technical as this question is, and so far-reaching in its influence on so many States and upon the Government, also, that it is literally impossible for any committee of Congress, with all the other work it has to do, to really get at a definite and safe result from reading the reports of this hearing. I want to conclude what I had in my mind to say this morning by making the following recommendation as to what this committee should recommend. First, appropriate the seven and one-half million dollars necessary for the next calendar year's work, failing in which the Government will lose over $2,000,000, about a million dollars of which will be interest, and another million will be depreciation in the life of cofferdams which you can not artificially restore, and which cofferdams you will soon lose altogether.

You have been considering Muscle Shoals about 11 months, and, with all due respect, I do not think, because of the highly technical nature of this problem, that any set of men on earth would ever get anywhere if you held hearings and considered testimony 11 months more, with all the other duties that you have to attend to. I think you should refer the whole matter, after having provided the seven and a half million dollars to go ahead with, to the Federal Water Power Commission, with instructions to acquire, in the United States or elsewhere, a thorough, practical, and scientific report on Muscle Shoals from the best business and scientific and engineering experts that money can provide. Don't have the experts work for nothing. I think that seeking to impose heavy responsibilities (except in time of war) without normal compensation is one of the most foolish things any government does. Here we are, 108 or 110 millions of people, the richest people in the world, and trying to sponge brains. In so far as I have been able to learn from much inquiry, the Government of the United States is the only government in the world that pursues such a policy. The way to get results, in my humble opinion, is to hire a man for what his services are worth in the open market and pay him for them, and then demand and get results that can not come in any other way.

I would have the Federal Power Commission provided with at least $50,000 (one-tenth of 1 per cent of the cost of Dam No. 2 alone) to go to the bottom of this question. The Muscle Shoals solution requires technical, highly trained ability in several lines of work, and you are going to make a mistake if you do not get all the facts and have them intelligently studied and reported upon. After the Federal Power Commission gets all of the facts in this way, I would have the commission report back to Congress its recommendations as to what ought to be done. In no other way will Congress ever have the information upon which it can depend. There are three things that I would have the committee of experts examine into. In the first place, I would have them examine into Cooper's relations to this entire project—the efficiency of his plans, the question of whether his present contract should be continued or canceled or whether or not he is too conservative or not conservative enough—I would have these matters passed upon by people outside of anyone who has had anything to do with the project upon to date. The next thing I would have the question of fertilizer and its needs in the country, and the best method to secure it thoroughly investigated by people who are not tied up to anyone that might be interested in this project. Then, I would have the business men come in and I would have them investigate the whole question from a cold-blooded business standpoint; and, then, of course, I would have the question of the value of this power to the general public—distributed as a commercial power and what the results would be that would come therefrom—investigated. With such a set of facts, as I am recommending, before Congress, certified to and proved up and secured in the way that I recommend, you would have something you could go forward with and be sure you were securing the greatest good for the greatest number.

Senator HEFLIN. How long would it take to do all of that investigating?

Mr. COOPER. I think it would take six to nine months to do it the way it ought to be done.

Senator KENDRICK. But, in the meantime, you would go ahead with the construction of the dam?

Mr. COOPER. Yes, sir; it is a crime to hold back this construction as it is to-day. The Government is losing $2,500 a day every day you sit here and about it, and yet, of course, you must discuss it. You must all be convinced that the dam must be completed. Completed and devoted to intelligent

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use Muscles Shoals will be a great addition to our national wealth, as well as a great aid to the South. This intelligent use, however, can not be determined by hearings of the kind now under way. The determination must be made with the unrestricted aid of experts devoting all of their time to the problem until it is solved.

Senator HEFLIN. How long since the Government quit work on the dam, Colonel?

Mr. COOPER. About a year and a half.

The CHAIRMAN. Just a year.

Mr. COOPER. Just a year now.

The CHAIRMAN. Just about a year now.

Senator HEFLIN. Have you made any recommendations to the War Department, since the Government ceased work down there, as to what should be done with it?

Mr. COOPER. Done with what?

Senator HEFLIN. With the dam and the whole project?

Mr. COOPER. Yes; I made a recommendation to the Secretary of War about a year ago.

Senator HEFLIN. What did you suggest in that recommendation?

Mr. COOPER. Practically what I have told you to-day. I can put this recommendation in the record, if you want me to.

Senator HEFLIN. I missed part of this testimony, Mr. Chairman. I was called away.

Mr. COOPER. I made a report to the Secretary of War on March 14, 1921, following almost exactly the line that I am recommending to you to-day, and I will introduce this in the testimony, if you want it.

The CHAIRMAN. If anybody wants it in, or if you want it in, but otherwise——

Mr. COOPER. I think I would rather have it go in.

The CHAIRMAN. All right; it goes in, then. Just hand it to the stenographer.

Senator HEFLIN. Have you made this recommendation that you have just told us about, about the committee?

Mr. COOPER. No.

Senator HEFLIN. You have not suggested that before?

Mr. COOPER. Not to anybody. I have been moved to my suggestion about a committee of experts because I have been seeing the way the testimony of witnesses has accumulated. No person can read all this great mass of testimony understandingly and think of a hundred other things and get the right solution for the problem before him.

(The report referred to is as follows:)

NEW YORK, N. Y., *March 14, 1921.*

Hon. JOHN W. WEEKS,
Secretary of War, Washington, D. C.

DEAR MR. SECRETARY: At the time of my interview with you in your office on March 12, 1921, you asked me the following questions and received the following replies thereto relating to the Muscle Shoals development in the Tennessee River, at Florence, Ala.:

1. Question. What is your relation to this Muscle Shoals work?

Answer. I am the consulting engineer for this work and under the direction of the Chief of Engineers. I am making all of the plans and supervising the inspection of all permanent work, and am furnishing this service on the basis of cost without profit.

2. Question. How did you come to accept the position of consulting engineer for this work for the United States Government on such a basis?

Answer. When I was on duty in France during the war I was ordered home by the Secretary of War to build this dam as a war measure. After I had been at work on the dam for about six weeks I was ordered back to France by General Persbing. When the war was over, because of the desire of the Chief of Engineers to follow recommendations I had made when I was in the service, he asked me to continue as consulting engineer for the Government, and this I have agreed to do under a contract that can be terminated by either party on 30 days' notice.

3. Question. Have you had in the past, or have you in contemplation in the future, any relations with any utilities or chemical companies that would be interested in purchasing the power that will be produced by this dam should it be finished?

Answer. No.

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4. Question. What is the conservative amount of power that can be developed from the Muscle Shoals plant, and upon what sort of data is your estimate of this amount of power based, and what will be the comparative cost of the energy produced if all existing estimates are verified in actual performance?

Answer. I have made a careful investigation of the Government records of flow in the Tennessee River at Florence, Ala., covering a period of 21 years, and have checked the rating curve used by the Government in its flow determinations.

I find that the plant should be developed for a gross installation of 550,000 horsepower, 100,000 of which will be practically uniform throughout every year, and the balance of 450,000 horsepower will be available for periods of time varying from 4 months to 11½ months of the year. The gross output of the plant when finished as now designed will conservatively produce 700,000,000 kilowatt hours per annum for all the year, or primary power, and 1,470,000,000 of part-time or secondary power. The above sums of energy are equal to an average of 382,000 horsepower per annum, making the proposed installation the largest on the American continent.

The estimates show that the primary power can be sold at 4.4 mills per kilowatt hour and the secondary power at 1.32 mills per kilowatt hour. These are prices that are very low in comparison to steam costs in this territory, and I am of the opinion that a combination of public utilities can be found willing to contract for this energy on terms that will eventually net the Government 5 per cent interest on the money that will be required to complete the plan.

The above figures pay for the navigation improvements, leaving nothing to be charged to navigation whatever.

5. Question. What is the total amount of money that will be required to finish the plant according to present plans?

Answer. $50,000,000.

6. Question. Is this estimate of $50,000,000 an absolutely safe estimate, and why?

Answer. The estimate is safe and ultraconservative because it is based upon unit costs developed in the expenditure of the $16,000,000 already in the job, and because it is based upon foundations and quantities to be built thereon which are now known and not subject to the usual construction hazards. In addition, the $50,000,000 estimate carries liberal allowances for contingencies, and I have no hesitancy in saying that the $50,000,000 amount is safely an outside figure.

7. Question. What amount of money is now invested in the Muscle Shoals project?

Answer. About $16,000,000.

8. Question. How much money will be needed to put the plant in commercial operation according to the plans you are now following?

Answer. $27,000,000.

9. Question. Do I understand you that all of the costs in your estimate of the locks and their approaches are charged to the power development, so that if your present plans are carried out the power produced will pay for the cost of the navigation improvement at this point?

Answer. Yes.

10. Question. Supposing that the Government, with the $17,000,000 appropriation now available for this dam, were to say to private capital, "You can have all of the work that is now in place if you will finish the project." Do you think private capital would be found which would accept the undertaking on this basis?

Answer. No.

11. Question. Why?

Answer. Because of the abnormal amount of money required to finish the project and the inabilty of private capital for some years to come to secure money at anything like a rate to compete with the Government's ability to borrow the money at a low rate during the same period.

12. Question. How much loss would the Government sustain if the work were shut down at this time for a period of three years and then undertaken and completed?

Answer. Approximately $4,500,000.

13. Question. If the work is not interrupted in the future, when do you estimate the first 100,000 horsepower will be ready for commercial use, and how long a time have you estimated will be required to sell all of the energy?

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Answer. The first installation of 100,000 horsepower should be ready for commercial use January 1, 1924. I have estimated that by 1935, if the energy is sold to public utilities, the entire amount of power will then be in use.

14. Question. What do you recommend the Government should do at this juncture?

Answer. The Government should provide $10,000,000 for the current year's work at Muscle Shoals, and carry on the project up to an ultimate expenditure of $43,000,000. At the end of the expenditure of $43,000,000 the navigation improvement will be completed and 100,000 horsepower will be installed and available for commercial use.

15. Question. What do you recommend the Government should do with this plant if it should finish it?

Answer. I am opposed to Government ownership and operation of any and all business. I recommend that the power created by the dam be leased either to public utilities in contiguous territory or leased to other private companies or corporations engaged in chemical or other operations that can make a better showing in the public interest than the public utilities can make. In this way the Government can avail itself of competition as between public utility companies on the one hand and chemical and fertilizer companies on the other. The war has produced great advances in chemistry requiring large quantities of electrical heat, and the Government through control of the energy that can be here created can, if competition is availed of, make an appropriate selection of the best use of this power for the good of the greater number of people.

16. Question. If the Government should finally decide to finish this work, what agency should administer the project when it is finished?

Answer. The Federal Power Commission, consisting of the Secretaries of War, Interior, and Agriculture. Subparagraph E of section 10 of the Federal water power law provides that the Federal Power Commission may issue licenses for such a condition as will obtain at Muscle Shoals if the Government desires to finish this work and thereafter lease its energy.

17. Question. If the Government should finally decide to lease the power from this dam to public utilities, what rate of interest do you think could be secured to the Government?

Answer. When the first installation, costing not to exceed $43,000,000, is in commission, the Government return will be at the rate of 3½ per cent according to the estimate I have made. When all of the energy is sold, after an additional governmental expenditure of $7,000,000, the total net earning to the Government will be safely 5 per cent per annum, with all operation and depreciation charges taken care of by the licensee.

18. Question. What do you think is the next move the Government ought to make in this matter?

Answer. The Federal Power Commission ought to go to Muscle Shoals and study this problem on the ground. Such a study should be supplemented by a careful check up of all of the facts relating to this project, and the Commission has appointees of its own who are capable of making such a check. After such a check is in hand the Federal Power Commission shouud make its recommendations to the President and the Congress of the United States in the premises.

19. Question. If no money had been spent on this project at all would you recommend the Government building it?

Answer. No. I am opposed to the Government ownership or Government in business. The Government has enough to do to attend to purely governmental matters.

20. Question. Then why do you recommend that the Government put in $26,000,000 in addition to the $17,000,000 now appropriated?

Answer. Simply because I do not think it good business for the United States to lose $17,000,000 that can be saved in a perfectly practical way.

21. Question. How large a power territory is reachable from this plant, and what influence has the Muscle Shoals plant on this territory?

Answer. About 60,000 square miles located in seven states. Power developed in this territory by private capital will be halted until the final program with rference to the Muscle Shoals dam is decided upon, and if this final program does not encourage private capital in this territory, there will, of course, be no further water power developed in this territory under such conditions.

22. Question. Why not make an arrangement with the public utilities now and use this arrangement as a basis for further expenditures by the Government if the plant must be finished by the Government?

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Answer. Such an arrangement can undoubtedly be made, but such a arrangement will close the door, in my judgment, to future competition as between public utilities and developments in chemistry, and such a closing of the door would undoubtedly be against the public interest.

Very truly yours,

(Signed) HUGH L. COOPER.

Senator KENDRICK. You do recommend to the Secretary of War——

Mr. COOPER. That we proceed with the work?

Senator KENDRICK. That we proceed to construct or finish the dam.

Mr. COOPER. Yes.

Senator KENDRICK. But they did not adopt your suggestion?

Mr. COOPER. No.

The CHAIRMAN. Congress did not appropriate the money?

Mr. COOPER. Congress tried to appropriate the money and did come within a few votes of passing the appropriation in the House.

Senator HEFLIN. It passed the Senate.

The CHAIRMAN. The work stopped because Congress did not appropriate any money to continue it. As you say, the appropriation passed the Senate, but it was defeated in the House.

Senator HARRISON. It lacked seven—six or seven—votes in the House.

The CHAIRMAN. Yes.

Colonel, you stated, when you were speaking of Mr. Ford's proposition, the only one you have studied, that in effect it was borrowing money from the United States Treasury at 2½ per cent interest. I wish you would explain just how you reached that conclusion.

Mr. COOPER. I will offer in evidence here a letter which I wrote to the various members of the Military Affairs Committee of the House on February 21, 1922, wherein all of the figures and facts are specifically laid down, so that anybody can read and find out exactly what it amounts to.

The CHAIRMAN. In that letter you give your reasons for that conclusion?

Mr. COOPER. Yes; and quote all the facts.

The CHAIRMAN. I expect we had better have the letter read.

Senator KENDRICK. Yes; it would not be a bad idea.

The CHAIRMAN. You can read it, or we will have somebody else read it.

Mr. COOPER. I will read it.

"NEW YORK, N. Y., *February 21, 1922.*

"Hon. JULIUS KAHN,

"*Chairman Military Affairs Committee,*

"*House of Representatives, Washington, D. C.*

"DEAR SIR: 1. Agreeable to the promise I made to the House Military Affairs Committee on Friday, February 17, I desire to submit the following analysis justifying the statement I made before the committee that the cost to the United States Treasury would be in reality $1,275,000,000 over and above the amount of money received from Mr. Ford should Mr. Ford's proposal be accepted as now before the committee.

"2. The above figure of $1,275,000,000 was arrived at, as stated in my testimony, by compounding the 4 per cent interest charge annually."

Later I found that the interest was always computed semiannually, and I recomputed it on the semiannual basis and produced the figures which I will now quote:

"Since my return to my office I have ascertained that all money borrowed by the United States Government carries semiannual interest payments instead of annual interest payments. I have therefore recomputed this Treasury deficit on the basis that the money borrowed for Dams Nos. 2 and 3 will cost the Treasury 4 per cent (2 per cent payable semiannually).

"3. In order that the committee may make a check of the figures quoted below, by referring them to the Treasury Department or any other department for verification, I desire to set down the following bases that were used by me in arriving at the total result, and these bases are taken from the formal contract proposed by Mr. Ford and from the cost of construction and carrying charges as estimated by the Chief of Engineers.

"4. *Dam No. 2.*—Basis (A). That Mr. Ford's 4 per cent interest payments, specified in paragraph 3 of his contract for Dam No. 2, will apply to $50,175,000, January 1, 1931."

In other words, when he begins his full 4 per cent interest payment, with respect to Dam No. 2, the Government will have spent $50,175,000.

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"This $50,175,000 is arrived at as follows:

Cost to date of Dam No. 2	$17,000,000
Net accrued interest before full 4 per cent payments begin	8,175,000
Cost to complete Dam No. 2	25,000,000
Total	50,175,000

(Above figures are Chief of Engineers' estimates.)

"Basis (B). That this 4 per cent interest (2 per cent payable semiannually) on $50,175,000 will run until January 1, 2025.

"Basis (C). That beginning January 1, 1932, Mr. Ford will pay annually into the Treasury of the United States, account Dam No. 2, $1,000,000 (4 per cent annually on $25,000,000).

"5. Using the above basis for calculation, I have assumed that the $50,175,000 principal as of January 1, 1931, and the interest thereon, thereafter compounded at the rate of 4 per cent (semiannual payments of 2 per cent), would be credited by the $1,000,000 annual payments made to the Government as and when they were made under the proposed contract. This method of crediting the payments direct to the account they are indebted to avoids the necessity of assuming that the Government would turn around and loan this money at 4 per cent.

"6. The above four assumptions—A, B, C, and paragraph 5— make a total unpaid cost of Dam No. 2 at the end of the lease period, which is January 1, 2025, of $1,076,800.

"7. *Dam No. 3.*—Basis (A). Mr. Ford's 4 per cent interest payment, specified in paragraph 7 of his contract for Dam No. 3, will apply to $33,000,000 January 1, 1931. This $33,000,000 is arrived at as follows:

Cost to build Dam No. 3	$25,000,000
Overflowed lands	2,331,000
New accrued interest before full 4 per cent payments begin	5,669,000
Total	33,000,000

(Above figures are Chief of Engineers estimates.)

"Basis (B). That this 4 per cent interest (2 per cent payable semiannually) on $33,000,000 will run until January 1, 2028.

"Basis (C). That beginning January 1, 1932, Mr. Ford will pay annually into the Treasury of the United States, account Dam No. 3, $1,000,000 (4 per cent annually on $25,000,000).

"8. Using the above bases for calculations, I have assumed that the $33,000,000 principal, as of January 1, 1931, and the interest thereon, thereafter compounded at the rate of 4 per cent (semiannual payments of 2 per cent), would be credited by the $1,000,000 annual payments made to the Government as and when they were made under the proposed contract.

"9. The above four assumptions—A, B, C, and paragraph 8—make a total unpaid cost of Dom No. 3 at the end of the lease period, which is January 1, 2028, of $409,100,000.

"10. The Treasury account against Dam No. 2 will show a deficit at the end of the lease period (see par. 6) of $1,076,800,000. With reference to Dam No. 3, the deficit will be $409,100,000, making a total Treasury deficit at the end of the lease period after crediting all of Mr. Ford's payments as called for by paragraphs 3 and 7 (Mr. Ford's contract) of $1,485,900,000.

"11. During the lease period, as per paragraph 10 of Mr. Ford's contract, there is to be in operation two amortization funds, as follows: For Dam No. 2, $19,868; for Dam No. 3, $3,505; both payments being paid every six months, beginning with specified dates. These two sums for the lease period, if invested at the rate of 4 per cent (2 per cent compounded semiannually), will return to the Treasury approximately $50,000,000.

"12. The net total deficit that the Federal Government must supply by general taxation, because of the failure of Mr. Ford's payments to foot the cost to the Treasury, becomes $1,485,900 (par. 10) minus $50,000,000 (par. 11), or a net deficit in the Treasury of $1,435,900,000.

"13. I believe that, with the above data before you, you will be able to see—(a) that the method of computing the cost to the Treasury is the correct and practical method, and tells accurately what the effect on the Treasury and the taxpayers in the United States will be; (b) That you will find if this question is investigated the bases for calculation and the mathematics applied to the same are both correct.

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"14. This letter does not cancel the statement made before the committee that the deficit would be $1,275,000,000, which amount is correct for annual interest applied to the $83,175,000 principal. The figures herein submitted are based upon semiannual interest payments on the same $83,175,000.

"Very truly yours,

"HUGH L. COOPER."

Now, all of the details and all of the bases are clearly set forth, and they are subject to anybody's check, and I beg to assure you that you can not find any intelligent person who will say that they are wrong or that there is anything that is incongruous or unreasonable in any of the premises.

The CHAIRMAN. The only criticism, Colonel, that occurs to me offhand, or at first blush, is this—that you are taking the entire cost, for instance, the $17,000,000 that has already been spent, and spent at a time when everybody was at the peak, that does not represent its worth. Everybody admits it is not worth what it cost. It seems to me if there is anything wrong with your figures it is that you have not deducted from the $17,000,000 the difference between the $17,000,000 and what it would cost to do that work now.

Mr. COOPER. My answer to that——

Senator KENDRICK. If I may interrupt, in other words, Mr. Chairman, it was your idea that the Government would not have proceeded to construct it at that time and at that cost, except under the pressure of war?

The CHAIRMAN. Yes. I think it is conceded that everything cost more than it would now, and a man buying it or renting it would not pay what it cost, but it is worth something, of course, and Mr. Ford does not count it at all in his proposition.

Mr. COOPER. My answer to that is this very important fact, that even counting the extra cost during the war, figuring the 4 per cent interest, on a basis including the $17,000,000, you get power cheaper than you can get it anywhere else in the United States by a large percentage. The proof of this is in the record I have submitted.

Senator KENDRICK. Therefore it is a good investment and worth the money?

Mr. COOPER. And is abundantly able to carry more than 4 per cent on past expenditures plus expenditures needed to complete.

Senator KENDRICK. I am inclined to think so myself.

Senator HEFLIN. How much do you claim that Mr. Ford will pay to the Government altogether in a hundred years?

Mr. COOPER. His amortization claim—he amortizes $50,000,000 and then he pays at the rate of 4 per cent on what the total cost to complete would be. I can give you the amount per annum.

Senator KENDRICK. Four per cent over and above what is already invested?

Mr. COOPER. Oh, yes.

Senator HEFLIN. He will have to pay a good deal more to the Government than the Government invested in the outset?

Mr. COOPER. No, no. Mr. Ford's proposal, if you want to get it down to very plain English, is to borrow money at 2½ per cent interest and thereby gain the cheapest water power on the American Continent for his sole and uncontrolled use for 100 years.

Senator HEFLIN. What I want to get at is, How much do you claim he will pay to the Government altogether from the time he gets it to the end of the hundred years?

Mr. COOPER. Well, I don't know as I can give you the grand total. He pays at the rate of about $2,000,000 a year.

Senator HEFLIN. Then he will have to pay to the Government at the end of 100 years more than the Government originally put into the investment?

Mr. COOPER. Say that again.

Senator HEFLIN. I say at the end of a hundred years he will have paid back to the Government more money than the Government invested at the outset in the project?

Mr. COOPER. That may be very true; but in the meantime at the end of a hundred years the Government is $1,435,000,000 out.

Senator HEFLIN. And the Government still owns the dam?

Mr. COOPER. Yes; but they have lost $1,435,000,000.

Senator HEFLIN. Mr. Ford claims that he will make fertilizer down there. You say the water power is the cheapest that can be obtained—cheaper than can be obtained anywhere else?

Mr. COOPER. Yes.

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Senator HEFLIN. Don't you think that will enable him to make cheaper fertilizer?

Mr. COOPER. I don't know enough about the fertilizer game to answer that question, Senator.

Senator HEFLIN. If he should be able to make fertilizers, would he not save during that hundred years, to the farmers of the United States, a great deal of money and would not the Government be justified in letting this dam out for such a project as that?

Mr. COOPER. Most assuredly; and you and I would get along fine there; but the trouble with your assumption is that there is no guaranty about it at all. I have been looking into the fertilizer business actively for 12 years, as have many others all over the world, and I can't find anybody that reliably and dependably knows anything about it.

Senator HEFLIN. Mr. Edison says that they are working it out.

Mr. COOPER. He does not know anything more about fertilizer than I do.

Senator NORBECK. Nothing more than the Agricultural Committee of the Senate.

Mr. COOPER. He does not know anything more about it than I do.

Senator HEFLIN. Mr. Edison says there is no doubt Ford can make fertilizers cheap there.

Mr. COOPER. With all due respect to Mr. Edison, if you knew the number of things he has said that haven't panned out you would not be carried away with his prophecies.

The CHAIRMAN. Colonel, I think it ought to be said, before you assume that unqualifiedly Mr. Edison did say that, that at least as I understood him he was considering there were going to be great improvements in time to time in the development of fertilizer and the extraction of nitrogen from the air, and so forth.

Mr. COOPER. Yes. Sure.

The CHAIRMAN. And he does not confine it to Mr. Ford any more than he does to anybody else. They are going to be able to make much cheaper fertilizer in the future than they have in the past. That is the way I understood it.

Senator HEFLIN. The question I had his assistant ask him was will Ford be able to make cheap fertilizers there for the farmers? and he said, "Oh, there is not doubt about it."

Senator NORBECK. Senator, you said cheaper fertilizer.

Senator HEFLIN. Yes. I said "cheaper".

The CHAIRMAN. He would have said the same thing about anybody making fertilizer. It was Mr. Edison's idea, as I gathered it, while he did not know anything about it himself, he knew that the human mind was working on the problem, and it was going to be greatly cheapened in the future. He did not know whether he would make it there or somewhere else, or whether they would use power to do it or not.

Mr. COOPER. It is not three years since everybody thought the cyanamid was the greatest fertiliger discovery in the world. At that time cyanamid was the keynote of the whole fertilizer situation. It was the only way out. It is not two weeks since I talked with the greatest fertilizer expert in the world, and in the course of the conversation he said that the cyanamid process was in the junk pile and that he did not know what the new process was going to be. He told me of one venture in Norway where $5,000,000 was invested under the direction of the finest brains that could be found in Europe, and yet they have gone into the hands of receivers because their process failed to produce the promised results.

Senator HEFLIN. Mr. Edison talked along that same line. He said there would be processes that would be invented that would make it cheaper and all. Mr. Ford claims to have a secret process.

Mr. COOPER. I know, but every man I have ever seen has at least one secret process and sometimes two or three. That is the way they have of dazzling the eye—the way they put up the smoke screen. Keeley had a secret process. I haven't any use for a fellow that won't put his cards on the table.

Senator HEFLIN. You would not want him to put his cards on the table before he got his patent, would you?

Mr. COOPER. Any process that is not by the patent stage and well along in the practical development stage will not be of much use to any of our living farmers as far as Muscle Shoals is concerned. I have nothing further to say, Senator.

Senator HEFLIN. You suggested about appointing a committee here and having experts examine the proposition, and business men examine it.

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The CHAIRMAN. Will you just withdraw that until I follow up this other line a little further, and take that up later, because he is on this question of Ford's proposition.

Senator HEFLIN. All right.

The CHAIRMAN. As I understood you, Colonel, your claim is that the figures you have shown about the money that Ford would pay would, if computed mathematically, amount to the loaning of public money to Mr. Ford at 2½ per cent.

Mr. COOPER. Yes; that is true.

The CHAIRMAN. Now, in connection with that, and right while you are on that power proposition, I would like to ask you what it would cost the Government or anybody else to take care of Dam No. 2 and Dam No. 3 after they are completed. What would be the upkeep charge on it?

Mr. COOPER. In my opinion about twice what Ford is allowing.

The CHAIRMAN. About twice what he is allowing.

Mr. COOPER. Yes.

The CHAIRMAN. Now, another thing I think would be important for us to know. Take the ordinary commercial value of the power developed there, of the electricity, in your judgment what would that be worth? It is interesting and important to know just what the Government is going to have when it finishes this and how much it ought to get from anybody who is going to buy it or lease it.

Mr. COOPER. You mean to say for general distribution?

The CHAIRMAN. Yes. Suppose we just put it on a cold business basis—if you and I owned it, had it all completed now, what could we go out on the market and sell it for, or operate it and sell the power. How much would we get for it on the market?

Senator NORBECK. Assuming, Mr. Chairman, that you had a contract for the Government furnishing the cheap money in connection with it?

The CHAIRMAN. No; I was trying to clear away all the underbrush and everything. Supposing, regardless of its cost, what is it worth when we get it?

Mr. COOPER. I think all the year primary power would sell for $20 a horsepower, distributed to local distribution companies, and that $10 for the secondary power would be about right.

The CHAIRMAN. Have you made computations so that you can say what that would be in dollars and cents?

Mr. COOPER. No.

The CHAIRMAN. You could make that in a minute, couldn't you?

Mr. COOPER. You see that involves distribution lines also. You have to figure in distribution lines. I think maybe I could answer your question this way better, and give you a more precise bit of information to go on. My figures show that distributing companies can come to Muscle Shoals and build their own transmission lines and pay the Government for the current received a price that would net the Government 5 per cent interest on the whole investment. That is the conclusion that makes me cross when Ford offers about 2½ per cent for the loan of $83,000,000, and a lot of good people thoughtlessly and under the influence of a very skilled propaganda exclaim, "Hail the miracle worker." They forget that this proposer is also the proposer of 12 or 15 power dams across the Mississippi River below St. Louis, a proposal absolutely impossible of consummation at any cost, and that he is the proposer of money based on kilowatts of energy and a lot of other proposals that, to say the least, are chimerical.

The CHAIRMAN. In round numbers that would be 5 per cent annually on $50,000,000?

Mr. COOPER. Yes, sir; $2,500,000.

The CHAIRMAN. Now, deduct the extent that you would——

Mr. COOPER. That is the net price.

The CHAIRMAN. That is net?

Mr. COOPER. Yes; that is net.

The CHAIRMAN. That is what I wanted to get.

Have you made any investigation, Colonel, in regard to the construction there on the Tennessee or its tributaries of dams for the purpose of impounding water?

Mr. COOPER. I have only made a general investigation, and such investigation as I have made shows almost conclusively that the value of the property would be increased, and will be increased at least 40 per cent by the construction of future sensible storages.

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The CHAIRMAN. You have not taken that into consideration in your $2,500,000?

Mr. COOPER. Not at all.

The CHAIRMAN. Or the probabilities are, assuming that your judgment is correct there, that by the proper construction of storage dams that income could be very greatly increased?

Mr. COOPER. At least 40 per cent.

The CHAIRMAN. I think that answers my question.

Now, Senator Heflin, excuse me for interrupting you.

Senator HEFLIN. Major Burns has some suggestions there.

The CHAIRMAN. Here are some suggestions, Colonel Cooper, made by Major Burns. First, the capital cost. I believe that is $50,000,000, is it not?

Major BURNS. What I had in mind was to get the details in the record to substantiate this net return of 5 per cent according to Colonel Cooper's suggestion.

Mr. COOPER. It is already in this record.

Major BURNS. In this Senate committee record?

Mr. COOPER. Yes. It is included in that letter.

The CHAIRMAN. There is capital cost and operating cost and maintenance and depreciation. Are those all in?

Mr. COOPER. They are all in here; yes, sir. The whole story is in here.

You will be interested, I am sure, in knowing that even if Mr. Ford paid 4 per cent interest instead of 2½ per cent interest the cost per horsepower would still be 20 per cent lower than it is anywhere else on the American continent, and that is all shown in the testimony which I have given here at the House committee, and with all the details, and that can be put in evidence here.

The CHAIRMAN. I would like to have you put that in.

Mr. COOPER. I will put that in.

The CHAIRMAN. The whole thing or are there some parts that you want to mark?

Mr. COOPER. I will mark the parts that I want copied.

(The excerpts from the hearings referred to are as follows:)

PROPOSED FORD CONTRACT FOR MUSCLE SHOALS POWER.

STATEMENT NO. 1.—BE DIFFERENCE BETWEEN MR. FORD'S LEASE PAYMENTS TO THE UNITED STATES TREASURY AND THE AMOUNT THE TREASURY WILL HAVE TO PAY OUT IF MR. FORD'S PROPOSAL IS ACCEPTED AS WRITTEN.

1. In what follows, 4 per cent interest is assumed to be the best interest rate the Treasury of the United States can avail itself of during the next 100-year period, and it is to be noted that this 4 per cent rate is the base rate of all the calculation in Mr. Ford's proposal, and therefore this assumption can not be criticized as inharmonious with the letter and spirit of the Ford contract now before Congress.

2. I find that at the time Mr. Ford will begin the payment of a full 4 per cent interest return to the Treasury of the United States the sums expended by the United States Government up to this 4 per cent payment basis, as estimated by the Chief of Engineers, will be as follows:

For completion of Dams Nos. 2 and 3	$50,000,000
Interest accrued during the construction prior to the beginning of the 4 per cent interest payments less interim interest payments made by Mr. Ford (War Department estimate)	13,844,475
Previously spent on Dam No. 2 (War Department estimate)	17,000,000
Cost of flowage rights for Dam No. 3 (War Department estimate)	2,331,000
Total	83,175,475

3. For the purposes of a fair and parallel comparison I have assumed, in order to get a correct figure representing the loss to the Treasury in dollars, in this transaction, that the Treasury cost of the above total of $83,175,475 at the rate of 4 per cent interest would be compounded annually for the lease period, thus producing a grand total of $3,304,095,000 demand on the Treasury.

4. Investing the $2,000,000 Mr. Ford proposes to pay into the Federal Treasury annually, which is 4 per cent of the estimated cost to complete the job, which estimated cost (United States Engineers' Department estimate) to com-

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plete is $50,000,000. Such a plan would return to the United States Treasury at the end of the lease period $1,979,185,000.

5. This, you will note, results in a grand total deficit (excluding the amortization payments in paragraph 10 of the Ford contract) to the Treasury of $1,324,910,000.

6. Mr. Ford's amortization payments, in paragraph 10 of his contract, are planned to amortize $50,000,000 of the above deficit, leaving a net deficit for the Treasury to provide for of $1,275,000,000.

STATEMENT NO. 2—RE AMOUNT OF LOW-TENSION HYDROELECTRIC ENERGY DELIVERED TO GENERATOR STATION BUS BARS THAT WILL BE CREATED BY THE COMPLETION OF DAMS NOS. 2 AND 3 ACCORDING TO THE REQUIREMENTS OF MR. FORD'S PROPOSAL.

A kilowatt is 1⅓ horsepower.

A horsepower is three-fourths of a kilowatt.

Primary power is power that is available 365 days per year.

Secondary power is power that is available for some fraction of 365 days per year.

The secondary power, mentioned below, will be available from a minimum of 4 months per annum to 11¾ months per annum.

1. When projects Nos. 2 and 3 are completed, and, making no allowance for the value of important storage reservoirs in the Tennessee River above Dams Nos. 2 and 3, that future public interest will require to be constructed, the capacity to be installed in projects Nos. 2 and 3 (No. 2, 600,000 horsepower; and No. 3, 250,000 horsepower) will produce an average annual kilowatt delivery to generator station bus bars as follows:

	Kilowatt hours.	
	Primary.	Secondary.
Dam No. 2	700,000,000	1,490,000,000
Dam No. 3	285,500,000	608,000,000
Total	985,500,000	2,098,000,000

2. The total annual energy (primary and secondary) supply from both stations will, therefore, be 3,083,500,000 kilowatt hours.

3. The average cost to Mr. Ford of the total energy in paragraph 2 is (see statement No. 3) $3,622,246 annually, or at a rate of 1.18 mills per kilowatt hour, a cost far lower (about 50 per cent) than can be arranged for elsewhere on the American continent.

4. In average generator station practice in the American hydroelectric field secondary kilowatt hours are figured at about 50 per cent of the value of primary kilowatt hours.

5. On the basis of the relative values specified in paragraph 4, the costs to Mr. Ford for primary and secondary power become as follows:

985,000,000 kilowatt hours, at 1.81 mills	$1,782,850
2,098,000,000 kilowatt hours, at 0.905 mill	1,898,690
Total	3,681,540

Mr. Ford's annual payment for the foregoing energy (par. 3) is slightly less than the above grand total, and therefore the use of the unit costs of 1.81 mills and 0.905 mill, respectively, for primary and secondary power is conservative.

It will be interesting to show now what the gross annual cost of $3,622,246, as shown in statement No. 3, applied to the energy produced from Dams Nos. 2 and 3, as shown by statement No. 2, will yield as to costs per horsepower per annum for the various classes of power. Assuming 8,000 hours' annual use for 24-hour power and 5,256 hours' annual use for the best annual load factor (about 60 per cent) that can be built up in commercial work in the territory reachable from Muscle Shoals shows the following horsepower net costs to Mr. Ford:

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(*a*) For 24-hour power annual cost, 8,000×1.81 mills×0.746=(primary power), $10.80 per horsepower.

(*b*) For 60 per cent load factor power annual cost, 5,256 hours×1.81 mills×0.746=(primary power), $7.10 per horsepower.

(*c*) For 24-hour power annual cost $\frac{8}{1.81}$ ×10.80=(secondary power), $5.40 per horsepower.

(*d*) The total energy of 3,083,500,000 kilowatt hours, specified in paragraph 2, is equivalent to an average of 517,000 horsepower used 8,000 hours per annum. This 517,000 horsepower will cost Mr. Ford $3,622,246 per annum, or at the rate of $7.01 per horsepower, a price considerably less than one-half of what similar power can be secured for elsewhere on the American continent.

NOTE.—The foregoing amounts of energy were computed for a capacity of 550,000 horsepower for Dam No. 2. These energy amounts have not here been increased to correspond to the 600,000 horsepower capacity called for at Dam No. 2 in the Ford proposal. This omission will amply provide for the capacity needed to develop a 60 per cent load factor for primary power as above used.

7. The horsepower costs to Mr. Ford, as specified in paragraph 6, are approximately half the same costs at Keokuk and at Niagara Falls, on either side of the international boundary, and similarly are less than half the costs of the same class of energy in the commercial power territory reachable from Muscle Shoals.

8. It is apparent, therefore, that the Ford proposal calls on the Federal Treasury for $1,275,000,000 during the next 100 years in order that Mr. Ford may secure sole unregulated possession of the greatest water power the South has and at a cost to Mr. Ford around one-half of what similar power is available for elsewhere on the American Continent.

STATEMENT NO. 3—RE OPERATION AND MAINTENANCE OF MUSCLE SHOALS WATER POWERS.

1. I estimate the annual cost to Mr. Ford to operate and maintain Muscle Shoals Dams Nos. 2 and 3, up to and including low-tension bus bars, will be:

Operation, 850,000 horsepower, at 60 cents per horsepower year		$510,000
Repairs and maintenance:		
For Dam No. 2 (specified in contract)	$35,000	
For Dam No. 3 (specified in contract)	20,000	
		55,000
Renewals:		
Machinery in power house—		
For Dam No. 2, to replace 18 units every 30 years, costing $16 per horsepower installed, calls for an annual sinking fund, bearing 4 per cent interest, compounded annually, of	155,000	
For Dam No. 3, to likewise replace units in this plant, requires	65,000	
		220,000
Buildings, etc.—		
For Dam No. 2, replacement of power house, auxiliary buildings, intake gates, screens, etc., annual charge	18,000	
For Dam No. 3, for similar replacements	7,500	
		25,000
Rental:		
For Dam No. 2, 4 per cent on estimated cost to complete for 600,000 hoursepower capacity, $27,000,000	1,080,000	
For Dam No. 3, 4 per cent on estimated cost for 250,000 horsepower capacity plant, $23,000,000	920,000	
		2,000,000
(The above total of $50,000,000 is the amount estimated by the Chief of Engineers as necessary to complete Dams Nos. 2 and 3.)		
Taxes, 850,000 horsepower, at 90 cents per horsepower year		765,000
(This charge includes local and State taxes only, as Mr. Ford's proposal, as written, excludes Federal Power Commission jurisdiction.)		

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Annual amortization payment called for in paragraph 10 of Ford proposed contract	46,746
Total yearly operating expenses after Dams Nos. 2 and 3 are completed	3,622,246

STATEMENT NO. 4—RE SHOWING IF 4 PER CENT INTEREST IS PAID BY MR. FORD ON TOTAL COST OF DAMS NOS. 2 AND 3, AND PAYS $79,432 ANNUALLY TO AMORTIZE $83,175,475, WHICH IS THE ABOVE TOTAL COST.

If Mr. Ford should amend his offer to pay 4 per cent on the total cost of Dams Nos. 2 and 3 (see statement No. 3, pp. 8, 9), his gross annual cost of power would be as follows:

(1) 4 per cent interest on $83,175,475	$3,327,019
(2) Add operation charges (as per statement No. 3, on pp. 8, 9), $3,622,246, less $2,000,000 interest charges	1,622,246
(3) Add to complete the amortization of $83,175,475, not included in item (2) above	32,686
Total annual cost for power	4,981,951

On the basis of the above annual cost of $4,981,951 applying to an annual production of 3,083,500,000 kilowatt hours, the kilowatt hour cost becomes 1.62 mills.

For primary power used 8,000 hours yearly, Mr. Ford's annual cost would be	$14.83
For 60 per cent load factor (general commercial power) primary power, Mr. Ford's annual cost would be	9.75
For 24-hour secondary power, Mr. Ford's annual cost would be at the rate of	7.41
The total energy created of 3,083,500,000 kilowatt hours is equivalent to an average of 517,000 horsepower used 8,000 hours per annum; this 517,000 horsepower will cost Mr. Ford	9.64

All of the above costs per horsepower are at least 20 per cent lower than present costs for the same classes of power elsewhere in the South or at Keokuk or Niagara Falls.

NOTE.—The use of 8,000 hours annually is here assumed for primary power, because 8,000 hours is about the average annual use when deductions for normal shutdowns and repair requirements are allowed for.

The above plan of paying 4 per cent on total costs would fully amortize the total costs of Dams Nos. 2 and 3 at the end of the lease period, and would save the Treasury of the United States during the lease period $1,275,000,000, equivalent to an average annual saving of over $13,500,000.

The CHAIRMAN. Colonel, there is a great difference of opinion among honest-thinking men as to the use of the power of this project that the Government might develop, as to whether there ought to be any regulation or preference given between a commercial corporation or individual buying the power and a public utility concern. Do you get the idea?

Mr. COOPER. Yes.

The CHAIRMAN. What is your idea on this question of power developed from navigable streams?

Mr. COOPER. I think that the public-ownership idea ought to be given a preference until everybody admits that it is not worth anything.

The CHAIRMAN. I am not speaking of public ownership, particularly. For instance, here if we develop this water power down there, whether you would give it to a man like Mr. Ford, for instance, so that he could build a big factory, whatever he wanted, and use it as he pleases, or whether we ought to give first preference to cities and villages?

Mr. COOPER. I think I would give first preference to cities and villages. It will benefit in the end a lot more people.

The CHAIRMAN. The point is if we give it to an individual it will benefit him, help him, but unless we have some regulation of the output that he is going to sell to the consuming public, I don't know how the consumer is going to get anything out of it?

Mr. COOPER. My understanding is that there is very little power that enters into Mr. Ford's fertilizer plans anyway, because the Haber process (the pres-

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ent best hope for nitrates) does not require much power. There will remain therefore a large amount of power that will go into a business that is not subject to regulation and this, I think, is wrong in principle. I am for regulation. I have been preaching regulation in Congress for 10 years, and am going to keep it up as long as I live. I believe that private capital is too selfish to be allowed to go unregulated. There are exceptions, but take it on the average they all need it.

The CHAIRMAN. I personally do not see anything wrong with the individual, if he should get this from the Government, manufacturing something or anything he pleases. He would get it as a financial venture and he would get all he could out of his project, and we could not find fault with him for doing it. All he would have to do, he would have to undersell the fellow that did not have such cheap power, and that is as far down as he would have to put his price.

Mr. COOPER. And he would stop right there.

The CHAIRMAN. The result would be that the public would not get but little benefit and he would get an immense benefit.

Mr. COOPER. Yes.

Senator NORBECK. When you get through I would like to ask one question. Maybe it is covered here already; and if so, it was before I came in. I understand you take the position that Ford would get really a bargain in this matter, the bargain consisting in part of a large property turned over to him for a very nominal consideration, but also in a credit extension on the part of the Government; in other words, the Government furnishing the money much cheaper than money could be secured in the open money market for this kind of an enterprise?

Mr. COOPER. Yes.

Senator NORBECK. After he gets this contract, if we give it to him according to his offer, what could he sell that on the market for? What could it be capitalized and sold at?

Mr. COOPER. I don't know. It would be a perfectly fabulous sum, because during the life of a hundred-year contract coal is going to cost four or maybe six times what it does now. It would be worth one hundred fifty to two hundred million dollars.

Senator NORBECK. You feel if we accept this proposal we will be giving him a gift of something like that?

Mr. COOPER. I should say that would be what you would do.

The CHAIRMAN. In other words, if we went into the contract according to his bid, and it was all signed up, he could turn right around and sell it?

Mr. COOPER. He could undoubtedly capitalize it for at least $200,000,000.

The CHAIRMAN. And there is nothing in the contract that would prevent it?

Mr. COOPER. No.

Senator HEFLIN. But he agrees to bind himself to the Government to manufacture fertilizers?

Senator NORBECK. With part of the horsepower.

Mr. COOPER. With part of the horsepower. You see, the guaranty that is inferentially referred to in the $10,000,000 that he proposed to put into fertilizer is a mere bagatelle as compared with the value of the franchise. He could afford to lose the whole fertilizer capitalization.

Senator HEFLIN. Did you state how many horsepower you thought could be produced there?

Mr. COOPER. From Dams 2 and 3 it amounts to an average of 517,000 horsepower per annum, based upon the present unregulated flow of the Tennessee River. Now, when the Tennessee is regulated—as it must be in the interest of the people of the South—that 517,000,000 horsepower will proportionately increase. The natural resource that exists there to-day is of tremendous potential value. If a man in the water-power business had come down here and proposed what Mr. Ford has proposed you would have killed him before he got through saying it.

Senator HEFLIN. Here is the situation we have, Colonel: We have a project down there, a dam across the river that is a block to navigation, making navigation impossible, and the Government has quit work on it. It was lying in that condition. Nobody seemed to want it. Nobody tried to get it for months and months and months. Mr. Ford made this offer, then other concerns put in offers, and still others commenced to fight Ford's offer, to keep him from getting it. Now, he is anxious to have it decided. He wants to get it now and go to work with it.

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Mr. COOPER. Yes.

Senator HEFLIN. He wants the Government to go ahead and complete it, or let him complete it, so that he will know what he is going to do about it. If we should take your suggestion and postpone consideration for months and months—and you admit it would take nine months——

Mr. COOPER. That is the maximum. It might be six, and it would be time and money well spent.

Senator HEFLIN. He might withdraw his offer and some of the others might withdraw theirs, and then the whole thing would go up in smoke, and we might not have the dam completed there, and nothing would be done with it.

Mr. COOPER. That is inconceivable.

Senator HEFLIN. You would think it inconceivable that the Government would quit work on it, would you?

Mr. COOPER. Not at the time it did quit work.

On this question of the moral obligation to Mr. Ford because he made the first bid, have you had your attention called to the fact that when he made the first bid it was $23,000,000 shy in the amount that the work was to cost?

Senator HEFLIN. That is, his payment?

Mr. COOPER. Yes.

Senator HEFLIN. He does not agree with you and others now as to what it would cost.

Mr. COOPER. In spite of his great knowledge about making Ford cars, he must have something to learn about the water-power business. I contend that I know more about it than Ford does.

Senator HEFLIN. He has done a great deal of constructive work. He claims if he had charge of it he could build that dam cheaper than you could, or cheaper than anyone else.

Mr. COOPER. If you get him before this committee, or if Mr. Mayo returns before this committee, ask him how he came out on his two water powers that he had the same wonder working idea about when he started, and what the final results showed.

Senator NORBECK. Who is going to make jitneys if Ford goes into the power business?

Senator HEFLIN. He might make jitneys down there.

You say he might make aluminum down there with some of this power. If he did, wouldn't that make competition for the Aluminum Trust and bring the price down?

Mr. COOPER. The Aluminum Trust, I think, has all the competition it needs just now and they seem to get along all right. What I am looking at is the value to the people of the country. Take Messena, N. Y. Have you ever been there?

Senator HEFLIN. No, sir.

Mr. COOPER. Mesina, N. Y., has 175,000 horsepower devoted exclusively to aluminum, and the population of the town is not much greater than it was 20 years ago. The aluminum industry does not build up a country, and what the South needs is to have its country built up to make it highly prosperous.

Senator HEFLIN. Mr. Edison says Ford would build up that section industrially if he got this project.

Mr. COOPER. He would in a little circle, undoubtedly, right around Muscle Shoals, but what about the balance of the South?

Senator HEFLIN. That would be that much. Every little is a help, is it not?

Mr. COOPER. I think the South would very greatly regret the situation that would be created by the adoption of this Ford proposal.

Senator HEFLIN. If Mr. Ford should get this project down there and manufacture fertilizers cheaper for the farmer, you admit that that would be a great blessing to them. Now, then, suppose he should die, as has been suggested, in 10 or 15 years. Then what would become of the farmers' cheap price? Could he not stipulate in the instructions that he might leave that the products of that mill or factory should be sold at a certain price, or not to make more than a certain amount of money above the cost of production?

Mr. COOPER. I think that is a legal question that I would not know much about; but may I make one statement with respect to that, and that is this:

I call the committee's attention to the fact that all over this world to-day there are numbers of very brilliant men trying to solve the fertilizer problem; and once you give a very favored position to Mr. Ford, and thereby shut off the power of universal competition, you will be making a mistake. The

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farmers will get their fertilizer through an open door a good deal quicker than they will through putting all the eggs in one basket, and that Mr. Ford's basket.

Senator HEFLIN. They have got them all in one basket now.

Mr. COOPER. I don't agree with you.

Senator HEFLIN. The farmer has nothing to say at all about the price of fertilizer. The Fertilizer Trust fixes the price of fertilizer. That is Ford's offer. Suppose he manufactures fertilizer on a large scale; don't you think that competition would tend to bring down the price of fertilizer?

Mr. COOPER. Ordinarily it ought to, if it went to that extent; but you can't manufacture fertilizer at Muscle Shoals and ship it any great distance. The freight rates eat it up.

Senator HEFLIN. Suppose it could serve Georgia, Alabama, Tennessee, and a few of those States around there; that would leave this other supply to go to the other sections and make fertilizer cheaper, and is not that worth considering in looking into these offers?

Mr. COOPER. If this committee of experts that I have recommended, after a thorough investigation, should say that was the right thing to do, I would say amen to it, but I don't know enough about it to have any fixed opinion about the fertilizer end of it.

Senator HEFLIN. But you don't like Mr. Ford's offer?

Mr. COOPER. I think it is a preposterous offer, and I am very sure that it will never be adopted by this Government. If it is, I shall want to leave the United States from sheer shame. I can not conceive of it being done.

Senator HEFLIN. You would rather see it just lie idle?

Mr. COOPER. Oh, no; I would not. I have too much reliance on the common sense of Congress. Everybody knows it ought to be finished. All you have to do is to find out what is the best way to do it; and the best way to go forward is, I think, along the lines I have recommended.

Senator HEFLIN. The farmers and organizations in the South and West have indorsed the Ford offer, and they say it is the only way that they can get the cheaper fertilizer, and they are very much interested in his offer being accepted.

Mr. COOPER. I don't think the farmer knows very much more about that sort of thing than engineers do about farming.

Senator HEFLIN. He is supposed to know more about his business than you know about his business, and you are supposed to know more about yours than he does.

Mr. COOPER. I am not pretending to know anything about it, so we are all right on that.

Senator HEFLIN. I think he knows more about his business than you or any other man does.

Mr. COOPER. I don't claim to know anything about fertilizer, therefore I want some expert advice.

Senator HEFLIN. Mr. Ford says he will not charge over 8 per cent above cost of production. That would be a wonderful thing to the farmers of the Nation. They suggest what would happen when he died. You remember Ben Franklin had it stipulated that the Saturday Evening Post should never sell for more than 5 cents, and it still sells for that.

Mr. COOPER. That was before my memory began to function.

Senator HEFLIN. He did it; he stipulated it should always sell for 5 cents, and it is selling for 5 cents now. Mr. Ford could stipulate in his will that whoever gets this property must sell the product at a certain price or a certain interest above the cost of production.

The CHAIRMAN. It ought to be in this contract. If that is going to be in Mr. Ford's will he ought to make his will and put it in the contract.

Mr. COOPER. I think so, too.

The CHAIRMAN. The trouble is that when he is dead, unless that is in his will, this corporation will be like any other corporation.

Mr. COOPER. Hit the rocks, and that is the end of it.

Senator HEFLIN. We might suggest that he put it in his contract that when he dies he will make some such provision.

The CHAIRMAN. Yes. There is not anything of that kind in the contract.

Senator HEFLIN. Not yet.

The CHAIRMAN. Is there anything else anyone wants to ask Colonel Cooper?

Senator HEFLIN. I would hate to see the colonel move out of the country; but I would be willing to take the Ford proposition for the benefit of the farmers of the United States in order to relieve them from the Fertilizer Trust and relieve

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us from dependence on Chile for our nitrate supply in time of war. I would be willing to have the colonel go and come back every now and then and see us.

The CHAIRMAN. We are very much obliged to you.

Before we adjourn, I have a letter that I think the committee ought to know about, and I will put it in the record, not as a part of the colonel's testimony but at the conclusion of it.

(The chairman thereupon read the letter, as follows:)

WAR DEPARTMENT,
Washington, May 19, 1922.

DEAR Mr. CHAIRMAN: I think I should inform you that I have an offer of $2,500,000 for the Gorgas power plant, the interest which the Government has in the railroad near there, and the transmission line from the Gorgas plant to Muscle Shoals. You will doubtless wish to bring this to the attention of your committee.

Sincerely yours,

JOHN W. WEEKS, *Secretary of War.*

Hon. GEORGE W. NORRIS,
Chairman Committee on Agriculture, United States Senate.

Senator HEFLIN. Does he state who offers it?

The CHAIRMAN. No; that is all he says.

The CHAIRMAN. Doctor Tolman wishes to make a further statement before the committee. We will hear you now, Doctor.

FURTHER STATEMENT OF DR. RICHARD C. TOLMAN, DIRECTOR FIXED NITROGEN RESEARCH LABORATORY, DEPARTMENT OF AGRICULTURE, WASHINGTON, D. C.

Doctor TOLMAN. After the testimony which I gave to the committee on May 19, the chairman of the committee asked me if I had not stated before the House Committee on Military Affairs that the Secretary of Agriculture was in favor of the Ford proposal in preference to a Government-owned corporation for the operation of the nitrate plants. I have discussed this matter with the Secretary, and wish to make the following statement:

The main interest of the Department of Agriculture in the nitrate plants is to secure their operation for the production of nitrogen for fertilizer purposes, and the department looks with favor upon any practical proposal which will insure the continuous operation of the plants for this purpose.

On February 14, 1922, the Secretary authorized me to make the following statement to the House Committee on Military Affairs:

"The Department of Agriculture believes that the farmers of the United States would be benefited by the operation of the Muscle Shoals plant to produce fixed nitrogen for use in fertilizers.

"The department understands that Congress has already decided against the operation of this plant by a Government-owned corporation, and that operation must be by a private individual or corporation.

"The department has collected a great deal of information as to the utilization of the plant and as to the possibilities for its future development, and stands ready to cooperate to the fullest extent possible with any agency which may secure the plant.

"Concerning the Ford proposal, if its terms are sufficiently definite and binding to make sure that the plant will be operated continuously for the manufacture of fertilizer, the department looks with favor upon its acceptance, believing that it will result in making available a considerably increased supply of fertilizer in time of peace and give us assurance of adequate supplies of explosives in case of need. The department does not undertake to pass upon the terms of the contract or venture an opinion as to whether they are sufficiently definite and enforceable to guarantee the continuous manufacture of fertilizer."

At the time the above statement was made the Ford proposal was the only one under consideration, and it was assumed that Congress, in failing to pass the Wadsworth bill, had definitely decided against the operation of the plants by a Government-owned corporation. Since then the situation has been modified by the presentation of other offers for the completion or operation of the properties in question, and also by the introduction of two bills, S. 3420 and S.

for the creation of governmental or quasi governmental corporations for ration of the nitrate plants.

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It will be seen from the above that the Secretary's main interest in the nitrate plants has been to secure their continuous operation for the production of fertilizer material. The Secretary has not desired to pass upon the terms of the Ford or any other proposal and does not desire to do so.

In case the Committee on Agriculture and Forestry should decide in favor of a Government-owned corporation for the operation of the nitrate plants the Department of Agriculture would be very glad to offer suggestions as to the character of the corporation to be formed.

The CHAIRMAN. On behalf of the committee I ought to say to you, Doctor, I think, that as to these suggestions, the committee would be very glad to hear them, through the Secretary of anyone whom he wishes to send here to any of these meetings. It is proper that they should come in during the hearings, because those bills are before the committee, the same as these offers.

Doctor TOLMAN. The Secretary does not wish to be put in the position of sponsoring any such idea.

The CHAIRMAN. No; I understand that.

Doctor TOLMAN. But if the committee should request such suggestions he will be very glad to send them.

The CHAIRMAN. Well, I do not know that I would be authorized by the committee to make any particular suggestion as to what he should do, but in that statement you conclude there with a paragraph which says you would be glad to make any suggestions. Now, there are two such bills pending before this committee. They are officially before this committee now, and we would be glad to have criticisms or suggestions or changes, not only in regard to every proposition that is here but in regard to every bill that is here, and we would be glad to have suggestions as to what the bill should be, if it is not here. This is open to the world and we would be very glad to have the Secretary either come in person or send whatever representative he wants to send, to make the suggestions he said he would be glad to make.

Doctor TOLMAN. I would be very glad to speak to the Secretary about the matter, Mr. Chairman.

The CHAIRMAN. Yes; I wish you would communicate with him.

We will now hear Mr. Downing.

STATEMENT OF MR. P. M. DOWNING, VICE PRESIDENT PACIFIC GAS & ELECTRIC CO., SAN FRANCISCO, CALIF.

Mr. DOWNING. Mr. Chairman, P. M. Downing is my name. I am vice president of the Pacific Gas & Electric Co., of San Francisco, Calif.

I do not know just what testimony I might be able to give to the committee here that would be of interest to it. It has been suggested, however, that the committee might possibly be interested in knowing what has been accomplished there in connection with the development of the water powers of that State by private capital. I am familiar in a general way with the situation in the South, having spent a few days at Muscle Shoals going over the situation there during September of last year, and I know that the situation in the South is comparable with that in our State. I would not attempt to go too far into the detail of the situation at Muscle Shoals, but having been intimately associated with the development of water powers in California for the past 20 years, I will be glad, if the committee is interested in knowing something of what has been accomplished there under private ownership and public control, to outline very briefly what has been done there.

The CHAIRMAN. I think the committee would be very glad to hear anything you have to say along that line, Mr. Downing.

Mr. DOWNING. We have in our State no developed water powers that are not devoted to public use. All are under the control of and operated by public utilities, either publicly or privately owned. California has done more than any other States in the way of developing its water powers. In hydroelectric output it ranks first. It is second only to New York in the amount of hydroelectric power installed. It has also done more in the way of interconnecting the various power developments than any other State. As a matter of fact, the systems of all of the power companies, whether water or steam, from the southern part of Oregon on the north to the Mexican line on the south, are connected into a common network of transmission lines. In this way we take advantage of the diversity of stream flows throughout the entire length of the State and also the diversity of load, and thereby obtain economies of operation not otherwise possible.

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As a result of this interconnection of transmission lines and other facilities, it has been possible to develop rural communities and to give a much more nearly universal service than would otherwise be possible. Our agricultural load is a very important part of the total. Our rates, too, are between 20 to 40 per cent lower than they are here in the East. This widespread distribution of service benefits the maximum number of people and the per capita consumption of power in California is greater than the average per capita consumption anywhere else in the country. To be exact, the per capita consumption in California is between two and two and one-half times as great as it is in any other State, and as I said a moment ago, I consider this the result of the unification of operation of all these various plants. There is not a single instance in the State where hydroelectric power is being used for private purposes. It is all devoted to the service of the public.

The CHAIRMAN. You mean by that operation of street car lines, the lighting of municipalities, streets, and houses, etc.?

Mr. DOWNING. Yes.

The CHAIRMAN. Is it sold directly to municipalities?

Mr. DOWNING. In some instances the power companies wholesale power to municipalities. In other instances the power companies distribute themselves directly to the individual consumers.

The CHAIRMAN. Has the Hetch Hetchy project been developed?

Mr. DOWNING. The Hetch Hetchy project is being developed at the present time.

The CHAIRMAN. There is no water power yet there that can be utilized?

Mr. DOWNING. No; the city and county of San Francisco only recently placed an order for the electrical equipment to go in the Hetch Hetchy project.

The CHAIRMAN. Has the dam been completed in the Hetch Hetchy Valley?

Mr. DOWNING. It is under construction at the present time.

The CHAIRMAN. When will it be completed?

Mr. DOWNING. It will probably be another year before the Hetch Hetchy Dam is completed.

The CHAIRMAN. Where is the water power in that system going to be developed, or is it going to be developed in several places?

Mr. DOWNING. There is one small development operating at the present time on the Hetch Hetchy project. That, however, is more or less of a temporary installation, made for the purpose of supplying power for the construction purposes. They have built one dam already and are using the water impounded behind that dam for the operation of this temporary plant.

The CHAIRMAN. Is there any water impounded at Hetch Hetchy itself?

Mr. DOWNING. No.

The CHAIRMAN. Not yet?

Mr. DOWNING. No. The water to be stored in Hetch Hetchy will be temporarily carried down a natural watercourse a distance approximately 12 miles, where it will be diverted into a tunnel approximately 18 miles in length to the first permanent power installation. After passing through this plant it is proposed to carry it on to San Francisco, where it will be used for domestic purposes.

The CHAIRMAN. How many power installations will there be in that project when it is all completed?

Mr. DOWNING. There have been a number of proposals—I think the present plan contemplates perhaps five or six all told.

The CHAIRMAN. That is owned by the county and city of San Francisco, is it?

Mr. DOWNING. That is owned by the city and county of San Francisco, yes.

The CHAIRMAN. As I remember it was contemplated that they would develop, in addition to getting water, 100,000 horsepower; is that about right?

Mr. DOWNING. That is about right; yes, Mr. Chairman. Their first installation, for which equipment is in order at the present time, will have an installation capacity of 50,000 kilowatts.

The CHAIRMAN. That electricity will be carried mainly, I presume, to San Francisco?

Mr. DOWNING. That is the plan.

The CHAIRMAN. And outlying suburbs?

Mr. DOWNING. That is the plan at the present time, although nothing has been done in the way of acquiring distributing systems in San Francisco or elsewhere, nor has anything been done in the way of providing a transmission line from their power house to the city of San Francisco.

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The CHAIRMAN. Do the laws of California give any preference as between the private individual or corporation and the public utility, in the use of power that is developed on the streams there?

Mr. DOWNING. No; it does not. As a matter of fact, with the exception of that of the city of Los Angeles, I do not recall any municipally owned water-power projects in operation at the present time.

The CHAIRMAN. No; I do not mean that. I mean if you, as a private individual, had under the laws secured the right to build a dam and you had constructed one and had a lot of electricity for sale, could you, under the law, sell that all to me for the purpose of manufacturing automobiles, for instance, or something of that kind, if there was a municipality or a railroad or something of that kind that wanted it?

Mr. DOWNING. I do not know that there is any distinction. As a matter of fact there has always been an adequate supply of power for privately owned and operated industries, as well as municipalities, so the question has never been raised.

The CHAIRMAN. Has there been any power development in the Los Angeles water aqueduct proposition?

Mr. DOWNING. There has; yes.

The CHAIRMAN. Are you familiar with that?

Mr. DOWNING. In a general way I am. Los Angeles has developed some power, the greater part of which, I understand, is now being sold through the Southern California Edison Co.

The CHAIRMAN. That is part of the water system of Los Angeles the same as Hetch Hetchy is a part of the water system of San Francisco, is it not?

Mr. DOWNING. Yes, sir; it is a part of their municipal water supply.

The CHAIRMAN. Yes. Well, the entire thing is not municipally owned, is it?

Mr. DOWNING. They have had an agreement with the Southern California Edison Co., which contemplates the city taking over at least a portion of the distributing system in the city of Los Angeles, owned by the Southern California Edison Co.

The CHAIRMAN. Well, the Southern California Edison Co. simply owns the distributing lines in the city of Los Angeles. Is not that the situation?

Mr. DOWNING. Yes. It also owns and operates a large number of water and steam power plants and distributes over a very large area outside of the city of Los Angeles.

The CHAIRMAN. The city of Los Angeles, however, develops its own power?

Mr. DOWNING. Yes.

The CHAIRMAN. And it is going to utilize that company and supply them with electricity and use their existing distributing system, as I understand it?

Mr. DOWNING. The city expects to eventually supply the consumers directly rather than through the privately owned Southern California Edison Co.

The CHAIRMAN. Yes.

Mr. DOWNING. Heretofore they have done that only indirectly by supplying power to the Southern California Edison Co., which company, in turn, has sold it to the users.

The CHAIRMAN. This private corporation, the Southern California Edison Co., now owns and did own the distributing system in the city of Los Angeles; is not that the fact?

Mr. DOWNING. Yes. There is an arrangement, however, whereby——

The CHAIRMAN. Now, they are going to get their electricity in turn from a development that is handled by the city itself?

Mr. DOWNING. A small part of it only.

The CHAIRMAN. Yes.

Mr. DOWNING. A small part of it.

The CHAIRMAN. When that system is completed, how much electricity will be developed there, do you know?

Mr. DOWNING. By the city of Los Angeles?

The CHAIRMAN. Yes. I mean connected with the water supply?

Mr. DOWNING. I can not give you that exact figure; no. My understanding is that there is something around 80,000 or 90,000 horsepower at the present time.

The CHAIRMAN. They have the water now in the city?

Mr. DOWNING. Oh, yes.

The CHAIRMAN. That is completed?

Mr. DOWNING. Yes.

The CHAIRMAN. Have they not installed their power units?

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Mr. DOWNING. They have, I think, two, or perhaps three, different plants, having an aggregate capacity of 80,000 horsepower. That is an approximate figure.

The CHAIRMAN. Do you know what it is going to cost?

Mr. DOWNING. No; I do not.

The CHAIRMAN. Have you made an estimate of what it is going to cost San Francisco in the Hetch Hetchy project?

Mr. DOWNING. I do not know that we have. It is very hard to allocate what proportion of the capital charge should be made to water and what should be made to electric power.

The CHAIRMAN. That is the same in both instances?

Mr. DOWNING. That is the same in both instances; yes.

The CHAIRMAN. Yes. Of course, that question is involved in each case.

Mr. DOWNING. Yes.

The CHAIRMAN. How did you happen to be examining Muscle Shoals, Mr. Downing?

Mr. DOWNING. I went there at the request of Secretary Hoover.

The CHAIRMAN. In whose interest?

Mr. DOWNING. At the request of Secretary Hoover, for the interest of no one, except the Government.

The CHAIRMAN. Well, how did Secretary Hoover happen to be interested on the part of the Government in Muscle Shoals?

Mr. DOWNING. I do not know.

The CHAIRMAN. Do you know that?

Mr. DOWNING. No; I do not.

The CHAIRMAN. Were you paid for making the investigation?

Mr. DOWNING. No, sir.

The CHAIRMAN. Well, are you not entitled to pay? Are you not going to get pay for it?

Mr. DOWNING. I did not ask for any pay at all. I received not a cent from anyone for making the investigation.

The CHAIRMAN. You came from California to do that?

Mr. DOWNING. Yes, sir.

The CHAIRMAN. At his request?

Mr. DOWNING. Yes, sir.

The CHAIRMAN. Well, do you know what Secretary Hoover expected to do about it?

Mr. DOWNING. No, sir.

The CHAIRMAN. Did he not give you any information as to what he wanted to know?

Mr. DOWNING. No.

The CHAIRMAN. Or why he wanted to make this investigation?

Mr. DOWNING. No; he asked me to go to Muscle Shoals, visualize the situation there, and then come on to Washington and discuss the matter with him, which I did.

Senator HEFLIN. When was that?

Mr. DOWNING. That was in either the latter part of August or the early part of September of last year.

The CHAIRMAN. Well, is Secretary Hoover interested in any way in this development down there?

Mr. DOWNING. Not that I know of.

The CHAIRMAN. You understood that his interest was as a Government official, did you?

Mr. DOWNING. Yes.

The CHAIRMAN. You made your report to him, did you?

Mr. DOWNING. Yes, sir.

The CHAIRMAN. What was the nature of your report?

Mr. DOWNING. I outlined to him the situation as I saw it in the very short time that I spent there.

The CHAIRMAN. In brief, what were your conclusions that you reported to Secretary Hoover?

Mr. DOWNING. I told him that there was a splendid opportunity there for power development, but that I thought it should not be developed as a private enterprise but under public regulation; and that the power should be used in connection with the other powers in the South in order that a maximum public beneficial use might be made of it.

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The CHAIRMAN. In other words, it should be hooked up with the other systems there the same as you have hooked them up in California?

Mr. DOWNING. Absolutely; yes, sir.

The CHAIRMAN. That it would become part of the network that is now composed of the Alabama Power Co. and the two or three other corporations over toward North Carolina.

Mr. DOWNING. In other words, I reached the conclusion after spending several days on the ground that the public generally would receive a maximum benefit by devoting the plant to the general service of the public rather than to turn it over to an individual industry in that immediate vicinity.

The CHAIRMAN. Did you make any investigation about the nitrate plants there?

Mr. DOWNING. No, sir.

The CHAIRMAN. Did Secretary Hoover express any interest in the nitrate proposition?

Mr. DOWNING. No.

The CHAIRMAN. Did he ask you to investigate that thing?

Mr. DOWNING. No; I am not familiar with the production of nitrates.

The CHAIRMAN. You did not know, even, how much of that power it would take to operate the nitrate plant?

Mr. DOWNING. No, sir.

The CHAIRMAN. Did Secretary Hoover make any inquiry about that?

Mr. DOWNING. No.

Senator HEFLIN. You went down there shortly after Mr. Ford made his offer, did you?

Mr. DOWNING. Yes, sir.

The CHAIRMAN. Well, did you make a report on the Ford offer?

Mr. DOWNING. I discussed it with Secretary Hoover; yes.

The CHAIRMAN. Was that a part of your mission down there?

Mr. DOWNING. Yes.

The CHAIRMAN. Now, what in a general way, was your report to Secretary Hoover on the Ford offer?

Mr. DOWNING. I told him I thought it would be a mistake to accept the Ford offer in the form it was in at that time.

The CHAIRMAN. Well, did Secretary Hoover ask you to report that to the Secretary of War, who had charge of the proposition?

Mr. DOWNING. Yes; I discussed it with the Secretary of War also.

The CHAIRMAN. Mr. Hoover sent you to the Secretary of War?

Mr. DOWNING. Yes, sir.

The CHAIRMAN. And you expressed the same opinion to him?

Mr. DOWNING. Yes, sir.

The CHAIRMAN. Did the Secretary of War have anything to do with having you go down there to examine it?

Mr. DOWNING. No, sir.

The CHAIRMAN. That was all Mr. Hoover's suggestion?

Mr. DOWNING. Yes, sir; all at Mr. Hoover's request.

Senator HEFLIN. Who paid your expenses, Mr. Downing?

Mr. DOWNING. The Pacific Gas and Electric Co., by whom I am employed.

The CHAIRMAN. Did they happen to be interested in Muscle Shoals, or why did they go to that expense?

Mr. DOWNING. The Pacific Gas and Electric Co.?

The CHAIRMAN. Yes.

Mr. DOWNING. They have no interest whatever in Muscle Shoals; absolutely none.

The CHAIRMAN. Yet they paid your expenses down there?

Mr. DOWNING. Yes, sir.

The CHAIRMAN. What is their business? What is the business of the Pacific Gas & Electric Co.?

Mr. DOWNING. The Pacific Gas & Electric Co. is engaged in the business of selling electricity, gas, water, and the operation of street railways.

The CHAIRMAN. In California?

Mr. DOWNING. In California.

The CHAIRMAN. Is Mr. Hoover interested in any way in that company?

Mr. DOWNING. Not that I know of. I do not know that he owns a share of stock in it or has any other interest in it whatever.

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The CHAIRMAN. What official position do you hold in that company?
Mr. DOWNING. Vice president.
The CHAIRMAN. Vice president?
Mr. DOWNING. Yes, sir.
The CHAIRMAN. Did you talk the matter over with the other officials of the company before you went down, before you made that investigation?
Mr. DOWNING. Yes.
The CHAIRMAN. Did you, or did the Pacific Gas & Electric Co. expect to have any interest in the Muscle Shoals development?
Mr. DOWNING. No, sir; none whatever.
The CHAIRMAN. The only reason you went down there was because Secretary Hoover asked you to?
Mr. DOWNING. Yes, sir.
The CHAIRMAN. Now, why should that company, then, pay your expenses across the continent because Secretary Hoover asked you to go and make this investigation?
Mr. DOWNING. They were perfectly agreeable that I should go.
The CHAIRMAN. In supplying gas and electricity to the public, under your public utilities commission of California the expenses of all of the officers of your company, such, for instance, as your expense in making a trip to Muscle Shoals, would be charged up as a part of the expenses of the company and would be included in the rates to the public so that the company would make a sufficient return over and above all of those expenses, would they not?
Mr. DOWNING. I presume that it would go in as an operating expense; yes.
The CHAIRMAN. Well, do you think that is an operating expense? Do you think that is a proper charge to assess against the operating expenses of your company in the supplying of electricity and gas to the public, and whose rates are regulated by the public utilities commission? Do you think that commission would allow that as an expense, if it was called to their attention?
Mr. DOWNING. I do not know. The amount involved is negligible and I do not think that the railroad commission of our State would question the propriety of such an expenditure when same was necessary in carrying out the request of a Cabinet officer. Speaking for the company I represent, we feel that when such a request is made it is our patriotic duty to comply with it.
The CHAIRMAN. Yes; probably no one would know it was there. The amount would be small, but if that was a proper charge, then there would not be any limit. You could go around the world and the other officials of the company could go around the other way, and those expenses would be charged up, and you could make the people who buy your gas and electricity pay those expenses.
Mr. DOWNING. We probably would not go that far, Mr. Chairman. I think a question might be raised if we got into an amount of that size.
The CHAIRMAN. Have you any further questions, Senator Heflin?
Senator HEFLING. I believe you said you reported unfavorably on the Ford offer?
Mr. DOWNING. I stated that in my opinion the Ford offer should not be accepted.
Senator HEFLIN. Mr. Ford has now modified his offer since then, has he not?
Mr. DOWNING. I understand so.
Senator HEFLIN. He now agrees to use a good deal of this power down there for the manufacture of fertilizer, and he agrees that he will charge only 8 per cent above the cost of production as profit. Do you not think, if the Government would let him have it to use in the manufacture of fertilizers on a large scale, that that would be a great blessing to the farmers of the country?
Mr. DOWNING. I do not know just what the 8 per cent means. Fertilizer at cost does not always mean cheap fertilizer.
Senator HEFLIN. Well, you heard Colonel Cooper's testimony about how cheap that power would be if Mr. Ford got it under the terms of his offer?
Mr. DOWNING. Yes.
Senator HEFLIN. And Mr. Edison said that there is no doubt that cheap fertilizers could be produced there. Would not that be of great benefit to the farmers of the United States, and are they not worthy of consideration in letting out this project down there? Ought not this project to be let out, Mr. Downing, to somebody who will use it for the benefit of the greatest number of people in the United States?
Mr. DOWNING. Oh, I think, as against the Government operating it, perhaps that would be a desirable arrangement; yes. However, in my opinion it ought

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to be put in the hands of somebody who would make the maximum use of it for the benefit of the greatest number of people.

Senator HEFLIN. Well, there are a great many farmers in the United States—several millions of them, and if they could be benefited by getting cheap fertilizers, that would probably be serving more people than it could be used for in any other way?

Mr. DOWNING. I do not know just how that would work out.

Senator HEFLIN. Is there any understanding between your companies out there and the companies of other sections? Have you any agreement about prices or anything of that kind?

Mr. DOWNING. Absolutely none. We are entirely under the control, both with respect to service and rates, of the State regulatory body.

Senator HEFLIN. And you say you serve people out there at a cheaper horsepower rate for your power than any other State? Was that your statement?

Mr. DOWNING. Yes, sir.

Senator HEFLIN. What was your statement about that—about its being 20 per cent cheaper than in any other State?

Mr. DOWNING. The power rates in California—not of the particular company that I happen to represent—are 20 to 40 per cent lower than those here in the East.

Senator HEFLIN. What is the overage price per kilowatt hour in your State?

Mr. DOWNING. I can not give you that figure. The average price received by the particular company that I represent, for the year 1921, was 2.1 cents per kilowatt hour.

The CHAIRMAN. Now, what did the consumer pay for that same electricity, do you know?

Mr. DOWNING. That is what the consumer paid to us.

The CHAIRMAN. All right. I do not believe you quite understand my question, because, if you do, that is a remarkably low price. Do you mean, for instance, that the person in a private residence in San Francisco pays 2.1 cents?

Mr. DOWNING. No, sir; that is the average rate, Senator. Do not get confused on that.

The CHAIRMAN. That is what I am trying to find out. What does the real consumer in the house pay for electricity in San Francisco?

Mr. DOWNING. The top rate, as I recall, at the present time, is 8 cents per kilowatt hour, plus a surcharge fixed by the railroad commission of 6 per cent. That is the top rate for a certain amount of power used by the individual household consumer.

The CHAIRMAN. Now, how does that compute, the 6 per cent feature, that you say is a surcharge? How much does it amount to when a man has to pay it? Suppose I lived there now instead of in Washington. How much would I have to pay per kilowatt hour in my residence for electricity?

Mr. DOWNING. For the first block of 30 to 50 kilowatt hours per month—I have not the exact figures here.

The CHAIRMAN. All right.

Mr. DOWNING. For that first block you would pay 8 cents per kilowatt hour, plus 6 per cent on the 8 cents, or 8.48 cents.

The CHAIRMAN. Yes.

Mr. DOWNING. For the next block of approximately 70 kilowatt hours for the month, the rate would be 6 cents per kilowatt hour, plus the 6 per cent surcharge. The rate becomes less with increased usage, the lowest rate being 3 cents per kilowatt hour. It should be understood that these are residential lighting rates only. Commercial lighting rates for office buildings, industrial plants, etc., are considerably lower than residential rates and power rates are even lower still.

The CHAIRMAN. Yes.

Mr. DOWNING. Now, let me make myself clear on that 2.1 cent rate. This is the average rate received for all power sold. Commercial power, of course, sells at a very much less rate that that.

The CHAIRMAN. Yes.

Mr. DOWNING. So that, taking the average rate for all power sold we receive 2.1 cents per kilowatt hour.

The CHAIRMAN. Oh, yes. It is not important that it be exact. It is interesting, however. Suppose this same householder that was paying 8 cents per kilo-

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watt-hour, plus the 6 per cent surcharge, had a stove, a cooking stove, would he get a less rate on that?

Mr. DOWNING. He would get a lower rate for that.

The CHAIRMAN. He gets a lower rate for that?

Mr. DOWNING. Yes; it takes a different classification.

The CHAIRMAN. Does he have to have two meters?

Mr. DOWNING. No; a single meter. He gets a lower rate in this way. We estimate the amount of power that will be required for lighting purposes, and any used in excess of that amount takes a lower rate.

The CHAIRMAN. Yes.

Mr. DOWNING. On the theory that the higher rate will apply for lighting and the lower rate will carry all of the energy used for cooking or heating.

The CHAIRMAN. That is, if you wanted to use some for operating a washing machine, that would take the lower rate?

Mr. DOWNING. That would take the lower rate; yes.

Senator HEFLIN. What is the average price for lighting purposes per kilowatt hour?

The CHAIRMAN. Senator, he has given us that.

Senator HEFLIN. Has he?

The CHAIRMAN. Yes.

Mr. DOWNING. That is for residential purposes.

The CHAIRMAN. Yes. That is 8 cents per kilowatt hour plus 6 per cent surcharge.

Mr. DOWNING. When it comes to lighting office buildings—commercial lighting, if you please—the rate is considerably lower than 8 cents. For instance, in some of the congested business centers in San Francisco the top rate will go down to 3½ or 4 cents, perhaps.

Senator HEFLIN. Then, the 8 cents was about the average price for that purpose?

Mr. DOWNING. That is about the average price.

Senator HEFLIN. For lighting purposes?

Mr. DOWNING. For ordinary residence use; yes.

The CHAIRMAN. You get your electricity from this net work, or your part of this net work, do you?

Mr. DOWNING. We have 28 different water-power plants feeding into this net work, and four steam plants. We purchase power from eight other companies engaged in similar business.

The CHAIRMAN. I guess that is all, Mr. Downing.

Mr. DOWNING. I would like to add that that company that I happen to be connected with is the third largest in the United States in electrical output, the only two having a greater output being the Commonwealth Edison Co. of Chicago and the Niagara Falls Power Co.

The CHAIRMAN. Have you any further statement you wish to make?

Mr. DOWNING. I would like to say that the favorable condition in our State has been brought about largely, if not entirely, by the fact that there has been this interconnection of facilities.

The CHAIRMAN. I think it is conceded that that is a great economy. When one branch of the system is crowded, they borrow from another branch which does not happen to be crowded at the same time.

Mr. DOWNING. We have never attempted to estimate the saving which ultimately results to the consumer by this net work, but in order that you might have some intimation of the economies that can be effected by a general interconnection of that kind, there was made here in the East, within the last year or two, a survey to determine how much of a saving could be made by a general interconnection of lines and systems, in exactly the same way as has been done in California. This saving, as I recall, amounted to something over $239,000,000 per year or approximately $750,000 per day.

The CHAIRMAN. Yes; I remember seeing that, and it is very important. In the development of water powers the most economical use of them, I think it is conceded, at least that we know of now, is to have them all connected, but I suppose the danger in that is monopoly. That is always true, however. A monopoly that is economical has to be guarded against so that it is not abused.

Mr. DOWNING. We, in California, do not regard it as a monopoly, because we are under such complete regulation by the State——

The CHAIRMAN. Yes.

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Mr. DOWNING (continuing). We feel that under public regulation it is impossible for monopolies, in the sense that we ordinarily think of them to exist.

The CHAIRMAN. Your regulatory body there is the railroad commission, is it not?

Mr. DOWNING. The railroad commission of the State; yes.

The CHAIRMAN. That commission, in addition to railroad regulation, has charge of the hydroelectric power companies, does it not?

Mr. DOWNING. Their authority goes to the control of all privately owned utility companies, and by "utility companies" I mean those supplying gas, electricity, steam, water, street railways, etc.

The CHAIRMAN. They have power to fix the rate after a hearing, absolutely?

Mr. DOWNING. Yes; absolutely.

The CHAIRMAN. If you were charging some community or some individual a rate and that rate were complained of, you would have a hearing before this commission?

Mr. DOWNING. The consumer has a hearing.

The CHAIRMAN. And then they fix the rate after hearing?

Mr. DOWNING. The supplying company is cited to appear and the railroad commission fixes the rate.

The CHAIRMAN. Yes.

Mr. DOWNING. I might say that the State regulatory body does not have control over municipally owned utilities. A municipality owning its own lighting system or its own water system is not under the control of the State regulatory body, the State railroad commission?

The CHAIRMAN. No.

Senator HEFLIN. Yet they have some authority in the city to regulate that?

Mr. DOWNING. No.

The CHAIRMAN. Not in the city, Senator.

Senator HEFLIN. I say the city has some authority.

The CHAIRMAN. Oh, yes. Well, the city owns it absolutely.

Senator HEFLIN. Yes. The people are there and have an opportunity to elect somebody to see that the proper charges are made?

The CHAIRMAN. Oh, yes.

Mr. DOWNING. But the railroad commission has absolute control over privately owned utilities supplying in cities?

Senator HEFLIN. Yes.

Mr. DOWNING. Not only in so far as the physical service is concerned but also with respect to the rates, the issuance of securities, the disposition of any property, etc.?

Senator HEFLIN. But what I meant was that if the city owned the plant, then the city government would regulate the price.

Mr. DOWNING. Yes.

The CHAIRMAN. They have authority to examine the books of these private companies and to see that they are not charging up expenses that are wrong, have they not?

Mr. DOWNING. The privately owned utilities are required to keep their accounts in the manner prescribed by the railroad commission.

The CHAIRMAN. Now, if they find that they are charging something that ought not to be charged against the cost they have jurisdiction to rectify the mistake, have they not?

Mr. DOWNING. Absolutely; yes. In other words, every privately owned utility must keep its books and accounts not as they themselves want to but as the State railroad commission says they must keep them.

The CHAIRMAN. Exactly. Now, if this State railroad commission in your case should find that, at the request of Mr. Hoover, you had spent several hundred dollars, and they had charged those expenses up, and if the commission had thought it was wrong for you to come down here to Muscle Shoals for this purpose, they could compel the company of which you were an officer to eradicate that charge?

Mr. DOWNING. Oh, I presume they could; yes. They have a right to throw out any charge that they think is not proper to go in as a charge against operation.

The CHAIRMAN. All right. We are much obliged to you, Mr. Downing.

That is the last witness for to-day, so we will adjourn here until to-morrow morning at 10.30 o'clock.

(Whereupon, at 12.30 o'clock p. m., the committee adjourned until to-morrow, Tuesday, May 23, 1922, at 10.30 o'clock a. m.)

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MUSCLE SHOALS.

TUESDAY, MAY 23, 1922.

UNITED STATES SENATE,
COMMITTEE ON AGRICULTURE AND FORESTRY,
Washington, D. C.

The committee met, pursuant to adjournment, at 10.30 o'clock a. m., in room 224, Senate Office Building, Senator George W. Norris (chairman), presiding.

Present: Senators Norris (chairman), Capper, Ladd, Ransdell, and Heflin.

The CHAIRMAN. The committee will come to order.

STATEMENT OF MR. FRANCIS L. HAWES, SPECIAL AGENT FEDERAL TRADE COMMISSION.

The CHAIRMAN. Will you give your name?

Mr. HAWES. Francis L. Hawes, special agent of the Federal Trade Commission.

The CHAIRMAN. How long have you been with the Federal Trade Commission?

Mr. HAWES. Eighteen years. That is, I was with the Federal Trade Commission and the old Bureau of Corporations.

The CHAIRMAN. You started in when the Bureau of Corporations was formed?

Mr. HAWES. Shortly afterwards.

The CHAIRMAN. And have been with them ever since?

Mr. HAWES. Yes, sir.

The CHAIRMAN. When the Federal Trade Commission was organized you were part of the bureau that went over to them?

Mr. HAWES. Yes, sir.

The CHAIRMAN. What has been your work since you have been with them?

Mr. HAWES. Largely investigation work, field work in connection with various investigations.

The CHAIRMAN. Have you made an investigation of the fertilizer industry?

Mr. HAWES. I took part in the fertilizer investigation in 1914 and 1915.

The CHAIRMAN. Has the Federal Trade Commission made any investigation since that date?

Mr. HAWES. No extended investigation since that date.

The CHAIRMAN. I know, but I think I had better ask you, for the record, you do not know anything about Muscle Shoals?

Mr. HAWES. No, sir.

The CHAIRMAN. You do not know anything about the cyanamid process or the Haber process for extracting nitrogen from the air?

Mr. HAWES. Only just as I have read some articles on the subject.

The CHAIRMAN. Do you know anything about the plants at Alabama near Muscle Shoals?

Mr. HAWES. No, sir.

The CHAIRMAN. The purpose of sending for you, Mr. Hawes, was to have you tell us something about the fertilizer industry. It has constantly been creeping out here, and I thought it would be well to have some one who had made an unbiased investigation tell us the result of it, just what you found.

Senator HEFLIN. I believe, Mr. Chairman, somebody testified that there were seven big concerns that practically controlled the price.

The CHAIRMAN. I presume this witness will know all about that. I have not talked with him about it, but the investigation closed when?

Mr. HAWES. I should say about the latter part of 1915.

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The CHAIRMAN. It went up to conditions during the war?

Mr. HAWES. During the early part of the war. The statistical part of this report ends July 1, 1914.

The CHAIRMAN. That was about the beginning of the war?

Mr. HAWES. Yes.

The CHAIRMAN. Go ahead in your own way and tell us all about the fertilizer industry. Is there a combination, and if so, what is it; and if there is not, tell us that; and is there any combination existing now, or has there been, that raised the price to the farmer more than it ought to have been?

Mr. HAWES. At the time of the date of this report supply and demand was what controlled the price of fertilizers and fertilizer materials, with the exception of potash. There was no combination and had not been since 1904 or 1905. At that time there was a close combination through a Canadian corporation, and that was broken up effectually in 1905 and 1906. Since that date, as far as the rest of the producers of fertilizers and fertilizer materials are concerned, there has been no combination, up to the issuance of this report.

The CHAIRMAN. Do you know anything about it since that date?

Mr. HAWES. No.

The CHAIRMAN. Has there been any complaint to the commission since then?

Mr. HAWES. There have been one or two complaints regarding the prices of nitrate of soda.

The CHAIRMAN. And they were investigated by the commission?

Mr. HAWES. Only so far as investigating so for as field work was concerned.

The CHAIRMAN. What did the investigation show? Was there merit to the complaint or not?

Mr. HAWES. There was no merit to it.

The CHAIRMAN. You say that there was no combination in the fertilizer field and that the fertilizer ingredients prices were controlled by supply and demand, excepting as to potash. Tell us how that was controlled.

Mr. HAWES. The potash was controlled by the German potash syndicate, which is a government monopoly.

The CHAIRMAN. In Germany?

Mr. HAWES. In Germany. Not only did it control the price but it controlled the output; did not allow new mines to be opened up.

The CHAIRMAN. How did that control the American market?

Mr. HAWES. It only controlled the American market, inasmuch as there was no competition in buying potash abroad. The price here was fixed; that is, the minimum price was fixed by the price in Germany.

The CHAIRMAN. There was no domestic supply?

Mr. HAWES. There was no domestic supply.

The CHAIRMAN. Did not the war break that up; not only did it break it up, but it shut off the entire supply from Germany, did it not?

Mr. HAWES. It shut off the entire supply.

The CHAIRMAN. What happened then?

Mr. HAWES. Well, we have opened up some sources of supply in this country—in the Nebraska lakes at Searles Lake, some from the kelp industry, and some from the cement industry. The total production from domestic sources, I think, only amounts to about 4,000 tons a year of K_2O.

The CHAIRMAN. That is not enough to supply the demand for fertilizer, is it?

Mr. HAWES. I should say from 10 to 20 per cent.

The CHAIRMAN. Where did they get the balance of it; or didn't they get it?

Mr. HAWES. They did not have it during the war.

The CHAIRMAN. So that would cause the shortage of the fertilizer. Well, we didn't have the nitrogen, either, did we, during the war?

Mr. HAWES. Well, we had plenty of nitrogen.

The CHAIRMAN. Yes; I believe we did.

Mr. HAWES. From the various sources—cottonseed meal, nitrate of soda, and sulphate of ammonia.

The CHAIRMAN. Most of it came from Chile, did it not?

Mr. HAWES. A large part of it came from Chile.

The CHAIRMAN. Of course, we were never shut off there during the war, although it was expensive to get it.

Mr. HAWES. The price went up. It more than doubled.

The CHAIRMAN. One reason for that high cost of Chilean nitrate was the export duty, was it not?

Mr. HAWES. The export duty.

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The CHAIRMAN. Put on by the Chilean Government?

Mr. HAWES. Put on by the Chilean Government, which I understand amounted to about $10 a ton, and is the largest source of revenue for the Chilean Government.

The CHAIRMAN. Are those American concerns still operated that you said started up during the war?

Mr. HAWES. I really do not know whether they are or not.

The CHAIRMAN. Take the Nebraska lakes, for instance, were they able to supply potash at a price that would compete with the German product when they got an opportunity to come in?

Mr. HAWES. Senator, I really know nothing about the cost of production of potash at the Nebraska lakes or Searles Lake. The price was several times the pre-war price of potash. If I remember rightly the war-time price of potash reached $2.50 per unit, compared to 70 cents per unit prior to that.

The CHAIRMAN. Do you know what has happened to the foreign supply from Germany and now from France? A good deal of it is from Alsace-Lorraine, is it not?

Mr. HAWES. Yes, sir.

The CHAIRMAN. Do you know what has happened to that supply?

Mr. HAWES. Why, no.

The CHAIRMAN. Are there any questions from any members of the committee?

Senator HEFLIN. What steps have you taken to prevent the control of prices by the Fertilizer Trust?

Mr. HAWES. You mean they control the price of manufactured fertilizer?

Senator HEFLIN. Yes, sir.

Mr. HAWES. No steps have been taken?

Senator HEFLIN. No specific case has been presented?

Mr. HAWES. No complaint has been made to the commission so far as I know. No charge has been made that there is a combination.

Senator HEFLIN. What did you say?

Mr. HAWES. No charge has been made that there is a combination among the fertilizer people.

The CHAIRMAN. If I understand your testimony here, if I get it right now, up to the war, in July, 1914, the investigation of the Federal Trade Commission shows that there was no such thing as a Fertilizer Trust.

Mr. HAWES. Yes, sir.

The CHAIRMAN. And that the price was controlled by supply and demand?

Mr. HAWES. By supply and demand.

The CHAIRMAN. There were no indications of an artificial control?

Mr. HAWES. None whatever, except, as I said, in the case of potash.

Senator HEFLIN. Mr. Chairman, I don't recall the name of the gentleman who testified before us the other day, but my recollection of his testimony is that he stated there were certain b'g companies that controlled the price.

The CHAIRMAN. Maybe this witness will know something about that.

Mr. HAWES. There are several large companies which control 40 to 50 per cent of the output of manufactured fertilizer.

Senator HEFLIN. If I remember his testimony he said they controlled 60 per cent.

Mr. HAWES. Forty-four companies controlled about 68 per cent. That is set out fully in this report of the Federal Trade Commission.

Senator CAPPER. Are there about as many companies now engaged in the fertilizer business as there were when that report was made?

Mr. HAWES. I don't think there are. I think that probably—as just an estimate, I should say 200 concerns less to-day than there were at the time this report was made.

The CHAIRMAN. Now, what caused that decrease?

Mr. HAWES. The inability of the small dry mixers to secure materials during the war.

Senator HEFLIN. A good deal of it happened by the big concerns buying them out, putting them under control?

Mr. HAWES. I could say that that really took place. I don't believe it did.

Senator HEFLIN. But you really have not investigated it in seven years?

Mr. HAWES. We have not investigated it in seven years. I do know that they have taken over some additional plants. For instance, the Virginia Agricul tural Chemical Co., took over a large plant in Indiana when it was completed.

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Senator HEFLIN. Then that would be counted under the head of big concerns?

Mr. HAWES. Yes, sir.

Senator HEFLIN. It would disappear as an independent concern?

Mr. HAWES. Yes, sir.

Senator HEFLIN. So that accounts for a good many of these concerns disappearing or appearing to be out of business, I suppose.

Mr. HAWES. Of course these small concerns that disappeared were what we term "dry mixers"; they had no machinery to speak of; a place just to mix the materials together and put them in a bag, etc. Their influence was entirely local.

Senator HEFLIN. They do no manufacture; they just mix?

Mr. HAWES. They just mix. There are two classes, or rather three classes, of manufacturers—the wet mixers, the dry mixers, and the wet mixers are also those who own their own chambers for manufacturing.

The CHAIRMAN. The fertilizer business is, to a great extent, a mixing business anyway, is it not?

Mr. HAWES. Largely so.

The CHAIRMAN. They get nitrogen and potash and phosphorus and mix them?

Mr. HAWES. Yes.

The CHAIRMAN. Now, some of the companies, as I understand it, manufacture their own phosphorus?

Mr. HAWES. Oh, yes; yes, indeed; many of them.

The CHAIRMAN. Are there any of them that manufacture their own nitrates or supply themselves from property that they own with their potash?

Mr. HAWES. Well, there are some that manufacture the nitrates in that they convert material which contains nitrogen in an unavailable form into an available form; they take any old animal matter, such as leather, feathers, derby hats, and things of that sort, and they make nitrogen of that. I don't know whether this is in point here at this time, but there were great quantities of animal materials available for fertilizer purposes in the past. At the present time those materials go largely into animal feeds.

Senator LADD. What are some of those products?

Mr. HAWES. Packing-house tankage.

Senator LADD. How much of the potash was imported a year at that time?

Mr. HAWES. I can give you the imports here out of a table I have. I think it ran up as high as a million tons.

Senator LADD. It ran up, you say, around a million tons, while we produced only 40,000 or 50,000 tons?

Mr. HAWES. That million tons was the gross.

Senator LADD. The gross?

Mr. HAWES. Yes. It probably did not contain over 400,000 tons of actual potash.

Senator LADD. How much Chilean saltpeter was imported?

Mr. HAWES. We used to import somewhere in the neighborhood of 600,000 tons. I can give you the exact figures.

Senator LADD. What proportion of the total nitrogen content of the fertilizer is made up of the Chilean saltpeter?

Mr. HAWES. I have got those figures right here. Now, what is your question?

Senator LADD. The question I asked was, "What percentage of the total amount of nitrogen is in the form of Chilean saltpeter?

Mr. HAWES. In the year 1913, 18 per cent.

Senator LADD. What amount was in the form of blood and like materials—tankage, etc.?

Mr. HAWES. Nitrate of soda about 30 per cent, sulphate of ammonia about 20 per cent, high-grade tankage about 15 per cent, cotton-seed meal about 30 per cent, and the balance was made up of cyanamid, concentrated tankage, dried blood, and dried fish scrap.

The CHAIRMAN. Did you, representing the commission, make any investigation as to the domestic supplies of potash in Utah?

Mr. HAWES. No. No one went out there to look at it.

The CHAIRMAN. You don't know anything about the beds out there?

Mr. HAWES. The development of that proposition took place just after the investigation was closed, and whatever information we have was secured through the Armour Fertilizer Works.

The CHAIRMAN. Are the Armour Fertilizer Works interested in the Utah proposition?

Mr. HAWES. They are, at Maryville.

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The CHAIRMAN. That is about 200 miles from Salt Lake City?
Mr. HAWES. Yes, sir.
The CHAIRMAN. Is that the company that Mr. Hanson is president of?
Mr. HAWES. I really could not say.
The CHAIRMAN. Do you know, or did you come in contact with Mr. Hanson in the fertilizer investigation?
Mr. HAWES. No.
The CHAIRMAN. That has developed since you made your investigation?
Mr. HAWES. That has developed since we made our investigation.
The CHAIRMAN. Do you know anything about it except what the ordinary person would gather from the newspapers in regard to the possibilities of potash production there?
Mr. HAWES. No; I do not.
Senator LADD. What per cent of the total fertilizers did you say were made by the larger firms—40 per cent, was it?
Mr. HAWES. I estimate about 40 per cent.
Senator HEFLIN. Did you name those concerns?
Mr. HAWES. No, sir.
Senator HEFLIN. Can you name them?
Mr. HAWES. Yes, sir.
Senator HEFLIN. I wish you would.
Mr. HAWES. The Virginia-Carolina Chemical Co., the American Agricultural Chemical Co., the Armour Fertilizer Works, the International Agricultural Corporation, F. S. Royster, Swift & Co., and Baugh & Co.
Senator HEFLIN. They are the big seven?
Mr. HAWES. They are the big seven.
Senator HEFLIN. There has been a good deal said in the newspapers about the Fertilizer Trust, and we have received letters about the trust, that they control the price of fertilizers, and are fighting the Ford offer. Mr. Ford, as you know, has made an offer to get Muscle Shoals?
Mr. HAWES. Yes.
Senator HEFLIN. We have just been wondering how we could get at these trusts and prevent them from holding up the farmers and charging any price they please for fertilizers.
Mr. HAWES. Of course, the farmer has a remedy in buying his materials and doing his own mixing.
Senator HEFLIN. Can he get his materials from somebody other than companies that are controlled by the big concerns?
Mr. HAWES. The Nitrate Agencies Co., of New York, has been making a specialty, or were at one time, of furnishing materials to the farmers.
Senator HEFLIN. But will they sell it much cheaper to the farmer than the big concerns?
Mr. HAWES. They did at that time.
Senator HEFLIN. That was seven years ago?
Mr. HAWES. Seven years ago.
Senator HEFLIN. You don't know what sort of methods they have employed since and are employing now to control the price?
Mr. HAWES. No.
Senator HEFLIN. That is all I care to ask, Mr. Chairman.
The CHAIRMAN. Senator Heflin, if you can suggest any witnesses about this fertilizer proposition, tending to show that there is a Fertilizer Trust, or anything of that kind, I should be glad to send for them.
Senator HEFLIN. There seems to be a question involved here whether there is really a control of the price to the farmers, and I would like to go into it. I think it has a bearing on this question.
The CHAIRMAN. I have sent for everybody that I have thought of and put them on the stand here.
Senator HEFLIN. I thought it was universally accepted that there is a Fertilizer Trust. I never heard anybody express a doubt about it.
The CHAIRMAN. I rather accepted it in my own mind at the beginning of this hearing, but I knew nothing about it. Of course, I do not come in contact with the fertilizer question like you do.
Senator HEFLIN. Our witness does not testify that there is no such thing as a trust now. He said, at the time they investigated it, seven years ago, there was not.
The CHAIRMAN. Oh, no; but if there is such a thing we ought to be able to find it.

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Senator HEFLIN. I would like to get some witnesses on the subject.

The CHAIRMAN. If you will give me the names, I will send for them. We did have one man here—of course, he would have been prejudiced somewhat—but if there is a trust, the head of the trust was on the stand right here the other day. I had him come from Chicago here. I have asked everybody to come that I could think of. I think that witness answered very frankly all the questions I asked him that would have a tendency to show a combination, although I knew nothing about it. The fertilizer question is something that in my State we never talk about. The only thing that happened was during the war they commenced to get potash out of those lakes and I came in contact with them. They wanted a tariff on it, which I would not agree to.

Senator HEFLIN. We have had two witnesses already who represent the farming organizations—Mr. Bower and Mr. Silver—who both testified that there was a Fertilizer Trust and that it controlled the price.

The CHAIRMAN. Well, their testimony was hardly direct on that proposition.

If there are no further questions, we will adjourn until 10.30 to-morrow morning.

(Whereupon, at 11.15 o'clock a. m., the committee adjourned until to-morrow, Wednesday, May 24, 1922, at 10.30 o'clock a. m.)

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MUSCLE SHOALS.

THURSDAY, JUNE 1, 1922.

UNITED STATES SENATE,
COMMITTEE ON AGRICULTURE AND FORESTRY,
Washington, D. C.

The committee met at 10.30 o'clock a. m., pursuant to call, in room 224, Senate Office Building, Senator George W. Norris (chairman) presiding.

Present: Senators Norris, Keyes, Ladd, McKinley, Smith, Kendrick, and Harrison.

STATEMENT OF HON. JOHN W. WEEKS, SECRETARY OF WAR.

The CHAIRMAN. Mr. Secretary, you know what we are considering. We will be glad to have you go on in your own way and give us your views and the result of whatever investigation you have made with regard to Muscle Shoals.

Mr. WEEKS. Don't you think, Mr. Chairman, that you had better direct the particular line of inquiry that you would like to have me discuss? This is a pretty comprehensive subject and I might wander away from the matters in which you are particularly interested.

The CHAIRMAN. We will do that if you desire it.

Mr. WEEKS. I would very much prefer to have such questions asked as the committee wish to have me comment on, and I think we will save time by that method.

The CHAIRMAN. Mr. Secretary, have you investigated the various bids that have been made?

Mr. WEEKS. I have investigated two of them with a great deal of care.

The CHAIRMAN. What two?

Mr. WEEKS. The bid made by Mr. Ford and the bid made by the Alabama Power Co. The other bids came in and had not been passed on by the department when I was ready to send the original proposition made by Mr. Ford, or the final proposition, to Congress. I thought it my duty to send those bids up here, but I did it without any comment, because the engineers and others connected with the department had not given them careful study. I refer to the Engstrum bid and the Parsons bid.

The CHAIRMAN. We will take the two bids that you have investigated. Will you give us your idea with regard to them in whatever order you desire?

Mr. WEEKS. Well, the first one is Mr. Ford's bid.

I suppose the committee understands that I had no power in this matter. I was simply delegated to receive propositions and transmit them to Congress. It seemed to me, however, that it was my duty to try to develop a bid that might be given serious and perhaps affirmative consideration. I could not ask for public bids under the conditions that obtained, and after I announced early in my encumbency in the War Department that I would consider bids and send them to Congress, an attempt was made to develop satisfactory bids. The first one that came in was Mr. Ford's. That was sometime in July of last summer. I did not consider that Mr. Ford's original bid was a satisfactory one. Of course, there is a great deal of sentiment connected with his name and accomplishments. People in that vicinity, and in the South very generally, have the feeling that there are not only going to be developed methods of producing fertilizers at a lower ultimate cost to the consumer than has obtained heretofore, but that there will be a great industry developed at that point. As an

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illustration of that I am told that land for many miles around Muscle Shoals has been optioned, the feeling being that Mr. Ford was going to do something similar there to what he had done in Michigan, and develop a great industry. That immediately gave the whole subject a great deal of interest in that region and in every section of the country where fertilizers are used. That was the principal incentive of the pressure behind the acceptance of Mr. Ford's first bid. That bid has been changed twice, and I notice in the morning's paper that his representatives are to come to Washington with a still further modification, based on some resolutions passed by the House Military Committee. I presume they are here to-day and before that committee. I don't know what that modification will be.

I could not recommend favorably Mr. Ford's first proposition. It was too indefinite in those parts which had to do with the very thing which the people were interested in—the obtaining of fertilizers at a lower cost. There was no guaranty behind it of any kind. I am not questioning Mr. Ford's good faith, but Mr. Ford's tenure of life is limited, and I wanted to be sure that if the Government were to sell a large amount of property for a nominal price, and was to involve itself in spending forty to fifty million dollars in addition at a rate of interest which is at least as low as the Government is likely to borrow for in the immediate future, we should have a certainty that the people involved down there were going to have a direct benefit. That subject was discussed and negotiations carried on for several months, not by Mr. Ford himself, especially, but by Mr. Mayo and Mr. Worthington, his representatives.

I finally stated that there would have to be some statement, some assurance, that an amount of money necessary to develop a great fertilizer plant was to go in there, and fertilizers must be manufactured as long as the contract lasted; and Mr. Mayo, who represents, as directly as anyone I know of, Mr. Ford, said Mr. Ford expected to spend ten or twelve million dollars in developing a fertilizer plant, and that he thought Mr. Ford would agree to do that and would agree to continuously manufacture fertilizers at that plant. Finally the negotiations got to the point where Mr. Ford came to Washington himself, and after a long discussion I asked him the definite questions—whether he would agree that a definite amount of money should be put into a plant to manufacture fertilizers, and he said that he would not guarantee any definite amount of money; and I asked him then if he would guarantee to manufacture fertilizer during the life of the contract—that is, for the 100 years—and he declined to do that. He said, in effect—practically these were his words—that, of course, he was not going to manufacture fertilizers if he could not do so at a profit.

That did not seem to me to be a satisfactory solution of the requirements. As I said, Mr. Ford may not live. He may intend to do all sorts of things, but he intends to carry on this business through a corporation. At that time there was no assurance as to what the capital of the corporation should be. It seemed to me that there must be a definite statement to the effect that fertilizers would be manufactured during the life of the contract, and that there should be sufficient capital behind the enterprise to carry it on.

We again asked Mr. Ford if he would agree to cancel the contract if he stopped making fertilizers, and he said he would not. That being the case, if he stopped manufacturing fertilizers, found that he could not do it at a profit, the Government would be in the position of having sold property that cost a large amount of money for $5,000,000 and loaning forty to fifty million dollars for a hundred years at 4 per cent without any benefit coming to the inhabitants of the sections of the country which use fertilizers.

He left me with that statement. When the proposition came in in writing, which he said he would modify somewhat—sections 17, 18, and 19 had been inserted—which do provide, as you all know, I presume, for a process of proceeding against Mr. Ford or his estate in case the purport of the agreement is not carried out. That is not satisfactory to me as a business proposition. Of course, Mr. Ford, and probably his estate, will be entirely responsible, but I do not see any method of proceeding against him, except for damages, and damages in a case of that kind, I should think, though I am not a lawyer, would be extremely difficult to estimate, and I think any arrangement made with Mr. Ford or anyone else, having in view the manufacture of fertilizers, should definitely provide that they shall be manufactured, that there can be no question about it, that there should be a guaranty of some kind which would prevent any legal entanglements.

In a general way, that is the Ford proposition. One of the objections which I have to it is that it involved the building of Dam No. 3. Dam No. 3 is not

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needed for any other purpose than for the purpose which Mr. Ford intends to put this plant to. I doubt if there is a market at this time in that general neighborhood for the power that would be developed by both dams. In any case, if I had it to do myself and were entirely responsible for it, I should develop Dam No. 2 and find out whether there was an additional market requirement before constructing Dam No. 3. That dam will cost $20,000,000 at least—probably more. Nobody knows just exactly how much it will cost. That is not true of Dam No. 2. The cost of Dam No. 2 can be pretty closely estimated. But there have not been sufficient soundings and borings taken at the location of Dam No. 3 so that, in my opinion, anybody knows what it will cost. This doubt relates to the kind of foundation in that neighborhood, which may be very substantial and solid, and it may be just the reverse. You may have discovered, on your visit down there at Hales Bar, a development some years ago, where it was the belief that $3,000,000 would make the development, but I am told that something like $11,000,000 were required. So that, I think, the fact is that in the case of Dam No. 3 nobody knows just what it will cost, and it was that doubt which led over a series of negotiations to Mr. Ford reducing the rate of interest which he would pay on the amount of money which Mr. Ford would put in, from 6 per cent to 4 per cent, he believing, and his engineers believing, that $40,000,000 would construct and equip both dams, and that 4 per cent of that would be substantially the sum of the ultimate interest that he had agreed to pay on the $28,000,000 in his original proposition.

Then there is this feature about it which I think may well be taken into consideration. The title to this property remains in the Government. That being the case, there will be no taxes, and I think that if that is going to be developed as a commercial operation the communities there are entitled to the taxes on that investment.

There is no provision in the Ford offer to put the sales of power which he may make—he has not said, neither have his representatives, that he was going to sell power, but they have said that he might—there is no provision that the price of that power shall come under the direction of the Alabama Public Service Commission. My judgment is that it would automatically come under the jurisdiction of that commission. If the power was sold by anyone, it is my judgment that it would have to be done under prices regulated by the Alabama Public Service Commission. That should be done, of course, in any case. That is about the general opinion that I have of the Ford offer.

The Alabama Power Co. offer is quite——

The CHAIRMAN. Before you take that up, Mr. Secretary, let us ask you some questions about the Ford offer.

Mr. WEEKS. All right.

The CHAIRMAN. The Ford offer includes the turning over in fee to Mr. Ford the interest of the Government in the Gorgas plant and also the transmission line from the Gorgas plant over to Muscle Shoals?

Mr. WEEKS. Yes.

The CHAIRMAN. Did you give that any consideration?

Mr. WEEKS. Yes.

The CHAIRMAN. Have you or have your advisers reached any conclusion as to the difficulties that might arise in the settlement of any disputes that might come about if we attempted to convey that property to Mr. Ford or his corporation?

Mr. WEEKS. There quite likely would be a legal controversy over that. I don't know whether there would or not. There were contracts made, you know, with the Alabama Power Co., the Air Nitrates Co., and the Cyanamid Co. relative to various matters there. The Judge Advocate General of the Army and the Attorney General have said that the Air Nitrates contract is not sound, is not binding. That, of course, I can not controvert, and I am not sure about it. In the case of the Alabama Power Co., it owns the land on which the transmission line is located; it has an interest in the railroad in the neighborhood, and it now has a lease of the Gorgas plant. I have transmitted to you an offer from the Alabama Power Co. for the Government's interest in the railroad, the Gorgas plant, and the transmission line which was built by the Government of $2,500,000.

The CHAIRMAN. Have you been down there, Mr. Secretary?

Mr. WEEKS. I have; yes.

The CHAIRMAN. You are familiar, then, with the way in which the property of the United States and the property of the Alabama Power Co. are intermingled?

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Mr. WEEKS. Yes.

The CHAIRMAN. Have you investigated to determine whether there would be any difficulty, legal or otherwise, if the Government should take its interest in that property and dispose of it?

Mr. WEEKS. Well, I think the Alabama Power Co., which is under the Public Service Commission of Alabama, would be inclined to take a broad and generous view of any matter in which the Government might be involved. Their record seems to indicate that. They turned over property at Muscle Shoals to the Government at the beginning of the war which had cost something like $500,000, and so far as I have been able to observe I do not think they would be contentious about those matters.

The CHAIRMAN. Even if they were not you are aware, I presume, that the houses, the residences of employees there, quite a large number, were built by the Government on Alabama Power Co. land; that the adjoining lot would be built on by the Alabama Power Co.; that there are other buildings there in which there is machinery owned in common by the two on land owned by the Alabama Power Co., and that the main building itself, the main steam plant, is on Alabama Power Co. land, part of it constructed by the Alabama Power Co. and part by the Government of the United States?

Mr. WEEKS. The interests are interwoven to a considerable extent. There is no doubt about that. If anybody is going to buy that particular property the Alabama Power Co. is the natural purchaser. It can use it to better advantage than anyone else. Moreover, I want to say that I do not see, while Mr. Ford has said that his offer must be taken in entirety and not in part, how that particular property is involved in the developments which Mr. Ford has in view. It is simply a question of furnishing additional power, but there will be immeasurably more power from the dams than will be required at Muscle Shoals, unless there is a very great industrial development there.

The CHAIRMAN. Well, what have you, if anything, to say, Mr. Secretary, in regard to the hundred-year proposition that is included in Mr. Ford's offer?

Mr. WEEKS. I am personally opposed to giving anyone power over a development of that kind for a hundred years. The Government has established a 50-year limitation in the water power act, which I think is quite enough. Nobody knows what is going to be developed in 50 years. A hundred years is a long time, and I have contended against that part of Mr. Ford's proposition from the start, that it was unwise for the Government to enter into an agreement of that kind, and especially with a provision which gives substantially an option to Mr. Ford to renew the contract, or for his successors to do so.

The CHAIRMAN. I would like to ask you a question or two that pertains to the Government entirely, and particularly to the War Department. We have been going on the theory here that it is absolutely necessary for the Government to keep that large plant in readiness as a war measure until at least such time as scientific men have developed a cheaper and better method of extracting nitrogen from the air. You are closer to the War Department, of course, than any of us, and we would like to know what, as head of the War Department, you think about the advisability of keeping intact the great plant there known as nitrate plant No. 2.

Mr. WEEKS. I think it is desirable for the immediate future, at least, that that be done. I believe there are going to be great developments in the fixation of nitrogen, and that within a reasonable time there will be plants or operations in many sections of the country that will be prepared to furnish nitrates by that process or by some other process; but for the present it is desirable, from the Government's standpoint, that that plant be kept in condition. That is one advantage of Mr. Ford's offer, and in fact all these offers provide that the plant shall be turned back to the Government, of course, if the Government needs it for its purposes, and Mr. Ford's offer provides that it shall be kept in condition to be turned back ready for operation at any time. I am not so clear in my mind about the other offers as to that one point.

The CHAIRMAN. At the end of the hundred-year period the title to plant No. 2, as well as all that other property outside of the dams and land adjacent thereto, belongs to the Ford corporation without any lien or without any restriction whatever?

Mr. WEEKS. Yes, sir; I think so.

The CHAIRMAN. In fact he gets fee simple title to all that property under his offer at once, with the only provision that he must keep the nitrate plant operative.

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Mr. WEEKS. The Government may take it over in case of necessity.

The CHAIRMAN. Of course the Government could do that anyway.

Mr. WEEKS. I am personally not disturbed about the nitrate situation. We have a very considerable amount of nitrates on hand. The amount is being reduced somewhat, but an ample supply for any need that we can see at present, because the War Department has a great amount of powder and ammunition on hand, and I am thoroughly convinced that before the War Department is going to require any considerable amount of nitrates for ammunition purposes we are going to have an ample supply available in the United States.

The CHAIRMAN. In case of war with some foreign power or combination of powers which had a reasonably large navy would it not be difficult for us to keep ourselves supplied if we were cut off from the Chilean nitrate beds?

Mr. WEEKS. As I have just said, if we had war now we have powder or ammunition enough on hand to fight a very considerable war. It is an embarrassment to us to know what to do with it. Some of it is being disposed of.

The CHAIRMAN. It would not last long in case we had a million men in the field, would it?

Mr. WEEKS. We have on hand something less than 200,000 tons of nitrates, and we can produce nitrates for war purposes at that plant. It would cost a little more, but it could be done with that steam plant. I think the Government's position, with that plant available, is entirely beyond criticism.

The CHAIRMAN. It is your idea, then, that we ought to take no step that would interfere with that plant or that would get it out of condition?

Mr. WEEKS. I think it should for the present be kept available, so that the Government may use it if it needs to.

Senator KENDRICK. It is your opinion, Mr. Secretary, of course, that it would be more readily available if it were put into operation in the manufacture of nitrates under conditions that would give the Government control of it in case of war?

Mr. WEEKS. It will be ready to use at once.

Senator KENDRICK. More readily available if it were running?

Mr. WEEKS. Undoubtedly.

Senator KENDRICK. Would you favor the plan to go ahead and finish Dam No. 2?

Mr. WEEKS. If there were none of these offers pending?

Senator KENDRICK. Yes.

Mr. WEEKS. Yes; I would complete Dam No. 2.

Senator KENDRICK. Without regard to any outside proposition?

Mr. WEEKS. Without regard to any outside proposition. I believe it can be completed without taking a dollar out of the Treasury and that there is a sufficient market, or will be in the early future, for the power that will be developed there to enable the selling of bonds in sufficient amount to finish the construction of Dam No. 2.

Senator KENDRICK. If the other conditions in Mr. Ford's offer were met, have you given any thought as to the relative amount that he is paying and would, in your judgment, his offer be a satisfactory offer for the property?

Mr. WEEKS. I don't know as I quite follow you, Senator.

Senator KENDRICK. Supposing that the conditions which you have outlined as to time of the lease, the guaranty of the manufacture of fertilizer, and other objections to his present offer which you have raised were met, would you then consider his offer of $5,000,000 for the Government's property a satisfactory offer?

Mr. WEEKS. I don't think $5,000,000 is a satisfactory offer for the Government property.

I will say definitely, Mr. Chairman, that if the fertilizer phase of Mr. Ford's offer were left out, if that were discarded and there was not the certainty that he was going to manufacture fertilizer and an assurance that it would be done at a cost that would enable the ultimate consumer to get fertilizer cheaper than heretofore, I do not consider Mr. Ford's offer a satisfactory one; and, therefore, if I had the power I should insist that that phase of his offer should be made beyond any question.

Senator SMITH. The fertilizer phase of the offer, you mean?

Mr. WEEKS. Yes.

Senator MCKINLEY. Mr. Secretary, you made the statement that you think Mr. Ford, if he was manufacturing power there, would be under the control, as to price, of the Alabama Power Commission.

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Mr. WEEKS. The Alabama Public Service Commission.

Senator MCKINLEY. Yes. I am rather under the impression—possibly there has been no decision, but I think the legal advice has been that selling power by a corporation of that kind to another one, they are not under that control.

Mr. WEEKS. I have raised that question several times, and you would know more about that than I would, Senator. It seems to me that no harm could be done to put into the agreement that any power sold should be sold under conditions imposed by the Alabama Public Service Commission. I have been assured that undoubtedly the laws of Alabama, the property being located in that State, would apply to it if sales were made, and that the commission would automatically have control over those sales.

The CHAIRMAN. I have had the understanding all the time, although there is nothing in Mr. Ford's offer to show it, but from the testimony of his representatives and general statements, that he does not intend to sell this power. If he did not sell it and this corporation utilized it in whatever business they might engage directly without any sale, then, of course, the Alabama Power Commission would have no jurisdiction whatever over it.

Mr. WEEKS. I have been told by Mr. Ford's representatives that it was not his purpose to sell power, and I assume that it is not his purpose now; but Mr. Mayo, as I recall it, did say that he might sell power for a time.

The CHAIRMAN. Yes; until they got their manufacturing operations started. I think that was the idea.

Senator KENDRICK. Is there not a chance for a conflict between the Alabama commission and the Federal authority on that question of selling power that actually belongs to the Government?

Mr. WEEKS. I doubt that.

Senator HARRISON. In New York there, in the development and sale of power from Niagara Falls, the Public Service Commission of New York has regulated the price. If the Alabama law is at fault, I think they could change it.

Mr. WEEKS. Yes. However, it would not do any great harm to put that into an agreement, if one were to be made, to insure its being done.

The CHAIRMAN. Are there any further questions now, before the Secretary leaves the Ford offer and takes up the next one? All right, Mr. Secretary, take up the Alabama Power Co. offer.

Mr. WEEKS. The Alabama Power Co. offer is of an entirely different character. I have hesitated about other offers, considering them favorably, which did not include the fertilizer feature directly and in the same manner that Mr. Ford's does, not that I have any assurance that Mr. Ford can manufacture fertilizers cheaper than others, and in fact there may be reasons to doubt it, but in any case that is a question in which the public is greatly interested, and if the Government is to charge off, must charge off a very large expenditure, its justification for doing so could be that it did involve a great public interest. Therefore, as I have said, I think there should be an absolute certainty about the manufacture of fertilizer. The Alabama Power Co. does not involve the Government in any additional expenditures whatever except to pay the cost of locks which will be necessary to get around Dam No. 2. That will not be over, I think, $2,500,000. It offers, as you know, to turn over to the Government or anyone designated by the Government to use it, 100,000 secondary horsepower. That secondary feature is one that ought to be considered by the committee. The Tennessee River is very irregular in its flow. There are periods when in all probability not over a hundred thousand horsepower, and perhaps less than a hundred thousand primary power will be developed by Dam No. 2—probably less; but for nine months of the year, relatively speaking, there will be developed very greatly increased power, and that is the power that the Alabama Power Co. proposes, if their offer is accepted, to turn over to the Government. It might last longer than nine months, and maybe somewhat less—perhaps 10 months or 8 months—but I think a fair estimate of it would be three-quarters of the year.

Senator SMITH. Mr. Secretary, what do the engineers estimate is the minimum primary horsepower that will be developed at No. 2?

Mr. WEEKS. I have seen 80,000 estimated horsepower, I think, as the lowest possible.

Senator MCKINLEY. Our testimony here is that it is 87,000.

The CHAIRMAN. Eighty-seven thousand three hundred is the primary power.

Senator SMITH. The maximum secondary power—that is, the flood water power—is what?

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Mr. WEEKS. I do not carry those figures in my mind, Senator.

Senator MCKINLEY. Mr. Ford requires them to put in 650,000 horsepower machinery.

The CHAIRMAN. There may be times in the year that it will exceed that, Senator. The testimony shows that, I think, without any contradiction.

Senator SMITH. I have not had the figures given to me, but I have understood that there are times when the guaranteed or primary horsepower would be down as low as 80,000.

The CHAIRMAN. Yes.

Mr. WEEKS. You ought to keep in mind that that additional power which is developed, 650,000 horsepower, will not all be secondary; a very considerable part of it will not be available more than six months in the year, I think, but the engineers' figures would be more accurate than my recollection.

Senator MCKINLEY. It is all in the testimony?

Mr. WEEKS. Yes; it is all in the testimony.

As a representative of the Government, trying to close up war contracts and war operations and liquidate as much as possible all the property which the Government does not need, leaving out the question of fertilizers altogether, the Alabama Power Co.'s offer would lead me to think that that was the better one for the Government to accept, if it were considering its own necessities, because it does not require additional appropriation, substantially speaking, and it does develop what that section will need—perhaps needs now—additional power—which I think the Government should have in view to help any community where it can do so in its disposition of such matters, and it would prevent the possible differences which may develop in settling the mutual relationships which, to some degree, exist between the Alabama Power Co. and the Government. I think those properties outside of the dams can be liquidated for very much more than Mr. Ford's offer without any particular trouble. While plant No. 1 has been a failure and has been considered of little value, I am not sure that the process can not be developed there which will make that plant a valuable property.

Senator KENDRICK. Right there, Mr. Secretary, I would like to ask you a question:

Is it not true, with the development of that power at dam No. 2, all of those splendidly constructed buildings will be valuable assets in themselves as manufacturing plants of one kind or another?

Mr. WEEKS. Yes.

Senator KENDRICK. If the Government chose to sell them for such purposes?

Mr. WEEKS. They will have material value, without any doubt, and I might add this: The committee may have noticed the large number of houses which are located at No. 1 plant and No. 2 plant. They are excellent houses. Their market value, to sell them under present conditions, is not very great, but if that power were developed, they would be a valuable asset, and I should have this in mind—have had it in mind—in saying if I had the power I would complete that dam. If that power is developed, it will mean that these houses will probably sell for possibly two or three or four times as much as they can be sold for to-day, and there is a large number of them.

Senator KENDRICK. In one locality I recall an entire addition built up of beautiful cottages, well constructed.

Mr. WEEKS. Yes; in two localities.

Senator KENDRICK. Well, I only saw one.

Mr. WEEKS. One at plant No. 2 and one at plant No. 1.

The CHAIRMAN. Has the War Department, or have you now, so that you can give it to us, the number of houses—residences, I am speaking of now—that the Government owns down there at Muscle Shoals?

Mr. WEEKS. Do you know, Major Burns?

Major BURNS. They own about 125,0000 at United States nitrate plant No. 1 and about 100,000 at United States nitrate plant No. 2.

The CHAIRMAN. How many permanent homes?

Major BURNS. That is, construction camps; no permanent houses to speak of.

The CHAIRMAN. There are some there.

Major BURNS. There may have been a few permanent houses, but practically all of these are construction camps.

The CHAIRMAN. Outside of those houses at nitrate plant No. 2, there are a lot of other houses that are not permanent?

Major BURNS. Yes, sir.

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The CHAIRMAN. Just temporary buildings—construction camps, as you call them. They have a vast amount of lumber in them.

Major BURNS. They have. They had, perhaps, about 20,000 down there during the construction period.

Senator KENDRICK. In addition to enormous development in the way of sewerage, I should say, and grading, and other work necessary in preparation for a community.

Mr. WEEKS. That is where the money went.

Senator KENDRICK. That must be, from appearances, rather permanent in its character.

Mr. WEEKS. Much of it is.

Senator MCKINLEY. Mr. Secretary, do I understand—is this the Alabama Power Co. offer, in a way: The United States Government keeps the nitrate plants; the Alabama Power Co. takes the dam as it stands and completes the dam No. 2 at its own cost; that from the power they first take 100,000 horsepower, then give the next 100,000 horsepower to the United States Government with the idea of operating the nitrate plant with it, but also further give the Government the right to use that power as they please?

Mr. WEEKS. It is some months since I have read that offer. When I sent this matter to Congress I dismissed it from my mind, which may account for my hesitation in some of the answers that I am making, but my recollection of the Alabama Power Co. offer—of course, an examination would determine that question—was that the power that it proposed to turn over to the Government was secondary power, not necessarily the second 100,000 horsepower, but that it was power that would be termed technically "secondary" power.

The CHAIRMAN. As I remember it, the Ford offer provides for the transfer to Mr. Ford in fee simple of everything except the dams and the things connected with the dams. The Alabama Power Co. has nothing whatever to do with anything except the dam, and it furnishes this 100,000 horsepower to the Government.

Senator MCKINLEY. It would get the power plant?

The CHAIRMAN. Yes; it would get the power plant. The Government can do what it pleases. The Alabama Power Co. has no offer in regard to the operation of the nitrate plant.

Mr. WEEKS. That is what leads me to say that if the Alabama Power Co., for instance, purchased that property in accordance with their offer, undoubtedly there would be very considerable development in that region somewhere, and perhaps right there at Florence and Sheffield, and that would make the balance of the property which the Government owns very much more valuable than it is to-day, which, to follow that thought, would enable the Government to salvage the property for very much more than it can do under present conditions.

I want to make a comment, Mr. Chairman, which may be purely superfluous on my part, but I think the members of the committee will appreciate that it is done in good faith.

Here is a great development which ought to be utilized. It ought to be utilized for the best interests of the Government and the community. As I have observed, the proceedings of this committee and the House Military Committee, you are proceeding on somewhat different lines. It is no criticism to say that Congress is hardly an administrative body. I think it will be pretty difficult to get any result in the early future out of these properties if Congress is to attempt to make a contract with anyone. I say this with a great deal of hesitation, because I am not seeking responsibility, and I would be glad to avoid it, but I think the businesslike way to proceed in this matter would be to authorize some one to perhaps ask for public bids or to proceed in some logical and businesslike way to dispose of that property, reserving to Congress the right to ratify whatever is proposed, and to appropriate, if any appropriation is necessary. I think by so doing you will get a much earlier solution of this question. Mr. Ford, the Alabama Power Co., Mr. Engstrum, and others are entitled to have it considered and decided at an early day. It is not a bad time to do it. Financing is relatively easy at this time for any of those who have bid, or would be for any other corporation or individual, and I believe you would get a much earlier and better solution if Congress could see its way clear to turn over to some one—engineers preferably, I think—the power to make the best possible agreement that can be made, Congress then having the right to ratify that agreement.

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Senator KENDRICK. It is your idea that it would avoid confusion for the Government to lay down and make public the plans under which it wanted to lease the property or sell its interest?

Mr. WEEKS. The War Department has this kind of a question of a minor way almost every day. We are selling properties of one kind or another constantly, and we are trying by every device to get as much out of them as we can. I would rather have somebody else do it, but the War Department would proceed to get the best possible bid for that property, taking everything into consideration, the Government's interest and the local interest and the future, and then that bid, whatever it is, should be submitted to Congress for ratification.

Only last week I sold at Newark, N. J., a development to the city of Newark. A very considerable part of the business of the War Department, a large percentage of its affairs, is doing that kind of work now.

I do not want it, but if the War Department had power to make a contract with somebody, to be ratified by Congress, taking into consideration all the requirements of the Government and the locality and the future, I think you would get action very much quicker, and I think the bidders whose bids are before you are entitled to as early consideration as possible.

Senator SMITH. You mean that the Government, in asking for these bids, would specify the particular things that they want incorporated in this bid?

Mr. WEEKS. Yes.

Senator MCKINLEY. What you mean is that a joint resolution be passed by Congress authorizing the Secretary of War to secure bids which he would submit?

Mr. WEEKS. I don't want you to assume that you would authorize the Secretary of War. I would very much like to avoid it. But my thought is that you would authorize somebody to secure bids. You may follow exactly the same course that was followed in the case of the Cape Cod Canal. The Government had taken over that property, and the Secretary of War and the Secretary of the Navy and the Secretary of Commerce were authorized to make a purchase. They could not agree on a price and it went to the courts. The verdict of the jury was not considered satisfactory, and the Government appealed. Since that time a better price has been made, and there is now pending on the calendar of the House a proposition to buy that property at what I think is a fair price. In any case, Congress in that case did reserve the right to ratify, and, of course, to appropriate, and so far as possible the departments have carried out their instructions.

Senator MCKINLEY. The trouble with the present situation with regard to Muscle Shoals is that all you could do was to receive something that somebody hands you without negotiating with them?

Mr. WEEKS. I had really no power. I tried at first to get something which I could recommend and approve.

The CHAIRMAN. Mr. Secretary, one of the difficulties down there is something that does not exist in anything else that I know of, and I am satisfied it does not exist in any of these cases you are speaking of. The Government has a property there in which it has about $100,000,000 invested, that everybody concedes we have to keep and keep in readiness, and it is interwoven and has a property there in which it has about $100,000,000 invested, that everybody interconnected with the Muscle Shoals development there in such a way that it would be conceded, I think, impracticable for the Government to sell everything it has there outright. I don't think anybody would want to do that. And, again, we would probably not be in favor of going in if it was an open question now, but we have gone in and we have spent so much money there, and the question is whether we ought to sell out now and get rid of the whole thing.

Mr. WEEKS. You understand, Senator, that the development of water power at Muscle Shoals is not absolutely essential to our making that plant effective.

The CHAIRMAN. Oh, I understand that.

Mr. WEEKS. It would cost more to use it as a steam plant, of course, but in case of necessity we can be producing the material which we need for war purposes very quickly, as the plant is now, as you saw it.

The CHAIRMAN. When you did that, however, you would eliminate the fertilizer proposition?

Mr. WEEKS. You would eliminate the fertilizer proposition entirely.

The CHAIRMAN. Because everybody concedes that with steam power we can not make fertilizer.

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Mr. WEEKS. That is true, therefore that is the crux of the situation. The pressure was just as strong to accept Mr. Ford's first proposition as it was his second one or his third one or whatever his fourth one may be, if there is to be a fourth. I submit that the second and third ones are infinitely better than the first one, and what I have been trying to do, without any prejudice whatever, is to try to get the best proposition possible, hoping that I could get one that I could say I thought Congress ought to accept.

The CHAIRMAN. Now, Mr. Secretary, if we had nitrate plant No. 2 just as we have it now, without having to spend any money on Dam No. 2, it would simplify it a good deal, too, because we could say then, "This is a war proposition, and we will keep it just the same as we keep a battleship, and on the same principle," but we have spent $17,000,000 on Dam No. 2. Now, the question is, Shall we throw all that away? We have there at Dam No. 2 a complete equipment, consisting of railroads, cars, engines, mixing machines and everything, to go ahead with. Shall we scrap that or sell it to somebody? So that complicates it still more. While it is not necessary to have Dam No. 2 to make nitrate, it is desirable, because it would cheapen the process. We can make it without the water power, as we have steam power enough to run it to its full capacity, but we have spent $17,000,000 and have a dam across the river there which I think everybody concedes at the present time is in No. 1 condition.

Senator HARRISON. And it is obstructing navigation.

The CHAIRMAN. Absolutely obstructing navigation. If we don't want to do something with it we ought to blow it up.

Senator HARRISON. As I understand the Secretary, he is perfectly willing to go ahead and complete the construction.

Mr. WEEKS. I am firmly of the opinion that Dam No. 2 ought to be completed, because I think it can be done to the advantage of the Government, and I think that community is entitled to something. You have a partly constructed situation there, which is a damper on the development of a community. Moreover, we could liquidate the balance of our property to much better advantage if this development were completed.

The CHAIRMAN. This committee has taken action toward appropriating money to complete that dam, and has authorized me to offer, and I will offer to-day, an amendment to the military affairs appropriation bill authorizing the War Department to go ahead with Dam No. 2 on the theory that whatever else we may do, and whatever action we may take, if any, we can fight out afterwards, but your department should be at work down there now in going on with that dam. Now, do you agree with the committee in that?

Mr. WEEKS. I want to have the committee, if it is going to take that action, authorize the War Department to contract for the completion of the dam and to make such appropriation as the Congress deems best to carry on the work for the next year, because if we do not do that we will not be able to make a contract ourselves, and I think by contract we could do it to better advantage.

The CHAIRMAN. What would you do with the Government equipment then?

Mr. WEEKS. Let the contractor use that equipment. Of course, all this work will be done under the direction of the Government engineers in either case. I think we can save money by doing it by contract.

The CHAIRMAN. If the committee thinks you should proceed in the future just as you have in the past, you would not advise that?

Mr. WEEKS. I would not advise it. We can do it, but I believe in the present condition of affairs—at least we could have done so three or four months ago—we can make a very good contract for the completion of that dam.

The CHAIRMAN. All of the engineers, so far as I have heard them, have agreed with us absolutely in the action we have taken.

Mr. WEEKS. Do you mean the Army engineers?

The CHAIRMAN. Yes.

Mr. WEEKS. I am not disposed to criticize my advisers in that capacity, but as a business man if I had it to do I should contract that work to be carried on under plans and general directions of the Army engineers. You would get just as good results, and you would get them for less money, in my opinion.

The CHAIRMAN. How long would it take you to get those advertisements out. You would have to advertise, I suppose?

Mr. WEEKS. I presume plans are all made, are they not, for the completion of the dam?

Major BURNS. I understand so; yes, sir.

Senator KEYES. That would not delay the work at all?

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Mr. WEEKS. It would not delay it. You would be working in 60 days.

Senator BENDRICK. Thirty days would be sufficient time to advertise for bids, would it not?

Mr. WEEKS. I think so.

Senator HARRISON. I think the action of the committee was that the work should proceed, whether by contract or otherwise.

Mr. WEEKS. I have seen it stated in the paper that the committee was considering appropriating seven and a half million dollars for carrying on that work, but that would prevent my contracting the work.

The CHAIRMAN. I don't think the Secretary could contract under the action we have taken.

Mr. WEEKS. I am firmly of the opinion that the Government could save money if I am able to contract.

The CHAIRMAN. Mr. Secretary, the men who have done the work are all there, as I understand it, right on the ground now?

Mr. WEEKS. Yes, sir; the engineers are there.

The CHAIRMAN. Everybody is there, and all the Government machinery is there, and it is all ready to start up if they had the money to do it.

Mr. WEEKS. Yes; at least the men who would supervise construction.

The CHAIRMAN. That is about all they do, anyway. I suppose the actual work is done by employees.

Mr. WEEKS. The machinery is all there.

The CHAIRMAN. Are there any other questions?

Senator SMITH. Would the action of the Government in completing that dam have any effect upon the pending propositions?

Mr. WEEKS. Of course, it would have a material effect on the offer of the Alabama Power Co. It would have some effect on Mr. Ford's offer also.

The CHAIRMAN. I think it is conceded by both Ford's engineers and the Alabama Power Co.'s engineers that while they would have to modify the bids it could be very easily done. It would not necessarily interfere. They would take it at a more completed stage than now; that is the only difference.

Mr. WEEKS. That work will be done substantially as either one of those bidders or any bidder would complete the work, in my opinion. It will have to be done, anyway, under the direction of the Army engineers.

The CHAIRMAN. Have you anything further, Mr. Secretary?

Mr. WEEKS. No.

The CHAIRMAN. We are very much obliged to you.

(Whereupon, at 11.45 o'clock a. m., the committee adjourned subject to the call of the chairman.)

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MUSCLE SHOALS.

SATURDAY, JUNE 3, 1922.

UNITED STATES SENATE,
COMMITTEE ON AGRICULTURE AND FORESTRY,
Washington, D. C.

The committee met, pursuant to call, at 10.30 o'clock a. m. in room 224, Senate Office Building, Senator George W. Norris (chairman) presiding.

Present: Senators Norris, Capper, Keyes, Ladd, McKinley, Kendrick, and Caraway.

STATEMENT OF MR. O. C. MERRILL—Resumed.

Mr. MERRILL. Mr. Chairman, when I was before your committee before I spoke of the various offers that had been made for the Muscle Shoals properties, and you stated that you would like to have me look over the bill which you had introduced and come back later and say what I wished to say with respect to that.

I discussed, when I was here before, the figures in relation to the power possibilities at Dam Nos. 2 and 3 on the Tennessee River. I wish to take up briefly at the start to-day the relation between the power available there and the nitrate plants.

The figures that I shall use here with respect to nitrates I have taken from what Major Burns has given me, and if I make any misstatements, I wish Major Burns would correct me now, because nitrate is a matter with which I am not personally familiar.

I understand plant No. 2 has a capacity of 110,000 tons of ammonium nitrate per annum, containing 40,000 tons of fixed nitrogen. Plant No. 1 I understand has a capacity of 22,000 tons of ammonium nitrate containing 8,000 tons of fixed nitrogen. This means that the two plants have a combined capacity of 132,000 tons of ammonium nitrate per annum or 48,000 tons of fixed nitrogen.

With a 2 per cent nitrogen content for fertilizer there will be enough nitrogen produced at plant No. 2 to mix 2,000,000 tons of fertilizer, and at No. 1 to mix 400,000 tons of fertilizer, a total of 2,400,000 tons, which is about 30 per cent, as I recall, of the total fertilizer production of the United States at the present time, such total being about 8,000,000 tons.

If the notrogen content were 3 per cent there would be produced from the two plants sufficient nitrogen for 1,600,000 tons of fertilizer, or about 20 per cent of our total present requirements.

The amount of power required for the production of a ton of fixed nitrogen by the cyanamid process, Major Burns tells me, is 15,000 kilowatt hours. The full operating requirements, then, for nitrate plant No. 2 are 600,000,000 kilowatt hours per annum.

Under the Haver process 8,000 kilowatt hours are required per ton of fixed nitrogen, which would mean an annual power requirement of, I should say, 4,000 killowatt hours, not 8,000. There are 8,000 tons of fixed nitrogen capacity in plant No. 1, which would require, therefore, annually, for full operation, 32,000,000 kilowatt hours. This is on the basis of using no electric power for

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the production of the hydrogen gas. If the hydrogen gas is produced by electrolysis of water, Major Burns tells me that a ton of fixed nitrogen would require 18,000 kilowatt hours, or a total for the 8,000 tons production of plant No. 1 of 144,000,000 kilowatt hours per annum.

So that on full operation we have either one of two figures. For nitrogen production alone in the two plants, 632,000,000 kilowatt hours; for nitrogen production plus hydrogen production for plant No. 1, 744,000,000 kilowatt hours. These are equivalent, on a 100 per cent load-factor basis, to 97,000 horsepower for the lesser of the two propositions, and 114,000 horsepower for the other.

If we translate these figures over into the power requirement per ton of fertilizer, we will find that under the cyanamid process (plant No. 2) the kilowatt hours required are 300 to 450, according to whether we assume the nitrogen content to be 2 per cent or 3 per cent of the fertilizer. By the Haber process the kilowatt hours will be 80 to 120, and if electric power is used to secure the hydrogen gas, 360 ot 540; in each case according to whether the percentage of fixed nitrogen in fertilizer is 2 per cent or 3 per cent.

On this basis the power cost per ton of fertilizer for every mill per kilowatt hour for electric energy will be: By the cyanamid process, for a 2 per cent content, 30 cents, and for a 3 per cent content, 45 cents; by the straight Haber process, with 2 per cent fertilizer, 8 cents per ton; for 3 per cent fertilizer, 12 cents a ton; and if power is used for the production of hydrogen gas, these figures would change to 36 cents per ton for the 2 per cent content and 64 cents per ton for the 3 per cent. That is, understand, when the power costs only 1 mill per kilowatt hour, and these figures will have to be multiplied by the factor which represents the actual cost of power in terms of mills per kilowatt hour.

The CHAIRMAN. For instance, if it were 2 mills per kilowatt hour you would double it?

Mr. MERRILL. It would be just twice these figures.

If we take the existing combination at Muscle Shoals of plants No. 1 and No. 2, without the use of power for the production of hydrogen gas, and at a rate of 1 mill per kilowatt hour, the power would cast, under the 2 per cent content, 26.6 cents per ton of fertilizer, and for the 3 per cent content, 39.5 cents per ton of fertilizer; and if power is used for electrolysis at No. 1 the figures would be increased to 31 cents per ton for 2 per cent fertilizer and to 46 cents per ton for 3 per cent fertilizer.

Senator MCKINLEY. Now, what does that tell a layman?

Mr. MERRILL. It simply means this, that you can tell, if you know the probable price of power per kilowatt hour how much of the cost of a ton of fertilizer is represented by the power.

Senator MCKINLEY. I know; but what you have told us, what does it tell a layman?

Mr. MERRILL. It tells the layman, I should think, that the power cost in fertilizer for every mill that he pays for power is only about 30 cents per ton of fertilizer.

Senator MCKINLEY. But what does that mean?

Mr. MERRILL. It means, in my judgment, that the cost of power is a very small element in fertilizer production; that it is other factors which are the determining ones there; and that with respect to the general situation at Muscle Shoals, whether the Government develops the power itself at a cost of 4 or 5 mills, or whether it buys from somebody else, or whether it accepts some such offer as the Alabama Power Co. has made of turning over a certain amount of power free of cost, makes very little difference in the actual cost of the fertilizer to the man who uses it; that it is other factors rather than the factor of power that are the real determining factors in the cost of fertilizer, and that far too much weight has been given to the claim that the cheap power at Muscle Shoals necessarily means a very considerable reduction in the cost of fertilizer.

Senator KENDRICK. In other words, your conclusion is that in the committee's action in dealing with Muscle Shoals it should not be controlled by the question of cost of this power in producing nitrates?

Mr. MERRILL. Unless you are otherwise required to get your power at a very considerable cost. For example, power at 1 cent per kilowatt hour would mean about $3 per ton for the power cost of a 2–8–2 fertilizer. If you get above that point you are getting into figures that really constitute a consider-

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able percentage of the total price, but 1 cent per kilowatt hour is higher than the current rate in Alabama for power in the quantities required for plant No. 2.

I don't know just how fertilizer prices are at the present time. The Bureau of Soils gave me figures yesterday which showed that 2–8–2 fertilizer had a manufacturer's sale price of about $46 per ton in 1920. I got a quotation from a local dealer here yesterday for 2–8–2 fertilizer at retail of about $26.

The CHAIRMAN. At about what?

Mr. MERRILL. $26.50 per ton retail of 2–8–2 fertilizer in the city of Washington.

The CHAIRMAN. How does that compare with this——

Mr. MERRILL. It is about half of the wholesale price of 1920.

Senator KEYES. Have you the wholesale price now?

Mr. MERRILL. The wholesale price? They gave it as $25 per ton wholesale.

The CHAIRMAN. And $26 retail?

Mr. MERRILL. $26.50 retail.

The CHAIRMAN. That is rather a demonstration of the fact that fertilizer has gone down quite a bit?

Mr. MERRILL. It has gone down very materially.

The CHAIRMAN. It has gone down very materially in the last year.

Mr. MERRILL. The 1–7–1 was quoted to me at $22 per ton retail. I have no corresponding quotations for 1920. But the quotations for 1920 varied from $32.75 for 1–8–0 composition to $67 for 4–8–4. Doctor Whitney, of the Bureau of Soils, tells me that the market for fertilizer and the prices of fertilizer are so erratic now that he is not willing to quote even an average price.

The CHAIRMAN. Why? Did he tell you why?

Mr. MERRILL. He said that one could get fertilizer for most any price that he would offer in cash.

The CHAIRMAN. By that we are to understand, are we, that the fertilizer people are in such financial straits that they are taking any price that they can get in cash for it?

Mr. MERRILL. I would rather suspect that both quantities on hand and the uncertainties of the future are responsible for it. That is something, however, with which I am not personally familiar.

The CHAIRMAN. We had considerable testimony in regard to the fertilizer people. They claim to be in very stringent financial circumstances; they have not been able to sell, and they have had to sell on time in a great many instances, and have not been able to collect their notes.

Mr. MERRILL. Until the price, or the cost, of power elsewhere gets up beyond, I would say, about one-half cent per kilowatt hour it would appear that fertilizers can be produced materially cheaper at Muscle Shoals only if some new or cheaper process for fixing nitrogen is discovered, or unless losses on nitrate production are made up from profits on something else, or unless some of the costs are ignored. If the Government or anybody else goes into the production of nitrogen at Muscle Shoals, it is to be assumed that they will endeavor to improve the process by every means they can. It must also be assumed that those in competition will be doing the same thing; and the possibilities, I would judge, not from my own knowledge but from what I read and hear about the nitrate situation—the possibility of cheaper fertilizers or cheaper nitrates for fertilizers is more a question of new processes than of cheaper power for their production.

There are several considerations that might be taken into account in determining what should be done with the properties at Muscle Shoals. There are large investments there, both in the two nitrate plants and in certain steam plants. They were built primarily for the purposes of preparedness in time of war, particularly for the immediate purposes of the recent war. I understand from testimony presented to your committee that the retention in operation or in condition for operation of nitrate plant No. 2 would be adequate as a war preparedness measure, with respect to nitrates; that the plant will be more suitable for that purpose if it is operated in the production of fertilizers than if it is merely held in a stand-by condition, for the simple reason that if it is kept in operation it will probably keep up with any changes in processes and will be improved as methods improve.

I had a table, which I forgot to bring along with me, which shows the relation between the 600,000,000 kilowatt hours required for the full operation of

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nitrate plant No. 2 and the amount of power available from Dam No. 2, hydro alone, and from dam No. 2 with the steam used in connection with it. I will give some of the figures as nearly as I can recall them from memory and then I will change them in the record if necessary.

With an installation of 240,000 horsepower at Dam No. 2, with a load factor of 75 per cent, the maximum daily average power that you could get with all the water you needed would be 180,000 horsepower. That is, three-fourths of the installation. There is not enough water in the river to produce 180,000 horsepower all the year through at Dam No. 2, but according to the figures that we have the total would have dropped down to as low as 75,000 horsepower for one or two days in the 26 years of record. The average, however, for the year through and for the 26 years with 240,000 horsepower installation would have been about 1,131,000,000 kilowatt hours, or approximately twice as much as the requirements for operation of nitrate plant No. 2 to full capacity. That figure does not include the 130,000 horsepower steam. If the hydro plant can operate on a 60 per cent load factor only the figure, of course, is slightly less, but in any event, with plant No. 2 developed, with an installation of only 240,000 horsepower at the dam, and with the steam plant forgotten, there is approximately twice as much energy in kilowatt hours as is required for the full operation of nitrate plant No. 2.

My first conclusion from this situation is that unless the United States is going into the fertilizer business on the proposition of monopolizing the market and supplying the full requirements of the United States, it does not need more than Dam No. 2 for fertilizer purposes, and that there is no occasion, in any event, at the present time for considering the development of plant No. 3, or of any other plant, or reservoirs on the upper Tennessee in connection with such nitrate-production as is possible with the existing nitrate plants, and that, even in the event that the United States proposed to go in there and double or treble the capacity of nitrate plant No. 2—which would mean construction of new nitrate plants—there would still be sufficient power for operation with an installation of 240,000 horsepower at Dam No. 2, for such installation plus the 130,000 horsepower of steam, both operating on a 75 per cent load factor, would produce approximately 1,800,000,000 kilowatt hours, or three times the 600,000,000 required for full operation of plant No. 2.

Muscle Shoals Dam No. 2—Power production with certain installations and assumed load factors.

Load factor.	Hydro.							
	1	2	3	4	5	6	7	8
	Installation (horsepower).	Maximum daily average output (horsepower).	Per cent time available.	Months available.	Horsepower hours per annum.	Millions of kilowatt hours per annum.	Millions of kilowatt hours in excess of 600.[1]	Per cent of total.
75 per cent	240,000	180,000	79	9.5	173,000	1,131	531	53
	300,000	225,000	71	8.5	204,000	1,333	733	45
	360,000	270,000	63	7.6	234,000	1,529	929	29
	420,000	315,000	56	6.7	263,000	1,719	1,119	35
	480,000	360,000	51	6.1	286,000	1,869	1,269	32
	540,000	405,000	47	5.6	306,000	2,000	1,400	30
	600,000	450,000	43	5.2	324,000	2,117	1,517	29
60 per cent	240,000	144,000	88	10.5	142,000	928	328	67
	300,000	180,000	79	9.5	173,000	1,131	531	53
	360,000	216,000	72	8.6	197,000	1,287	687	47
	420,000	252,000	66	7.9	223,000	1,457	857	41
	480,000	288,000	60	7.2	245,000	1,601	1,001	37
	540,000	324,000	55	6.6	267,000	1,745	1,145	34
	600,000	360,000	51	6.1	285,000	1,869	1,269	32

[1] Requirements for nitrate plant No. 2 in full operation taken as 600,000,000 kilowatt hours per annum.

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Muscle Shoals Dam No. 2—Power production with certain installations and assumed load factors—Continued.

Load factor.	Steam and hydro.									
	9	10	11	12	13	14	15	16	17	18
	Combined installation (horsepower).	Maximum daily average output (horsepower).	Per cent time available.	Months available.	Horsepower years per annum.	Per cent steam.	Millions of kilowatt hours per annum.	Millions of kilowatt hours in excess of 600.	Per cent of total.	Annual load factor.
75 per cent.....	370,000	278,000	79	9.5	270,000	34	1,764	1,164	34	73
	430,000	322,000	71	8.5	302,000	32	1,974	1,374	30	70
	490,000	368,000	63	7.6	332,000	29	2,170	1,570	28	68
	550,000	412,000	55	6.7	330,000	27	2,353	1,753	25	66
	610,000	458,000	51	6.1	384,000	25	2,509	1,909	24	63
	670,000	502,000	47	5.6	404,000	24	2,640	2,040	23	60
	730,000	548,000	43	5.2	422,000	23	2,758	2,158	22	58
60 per cent.....	370,000	222,000	88	10.5	220,000	35	1,438	838	42	59
	430,000	258,000	79	9.5	251,000	31	1,640	1,040	37	58
	490,000	294,000	72	8.6	275,000	28	1,797	1,197	33	56
	550,000	330,000	66	7.9	301,000	25	1,967	1,367	31	55
	610,000	366,000	60	7.2	323,000	24	2,111	1,511	28	53
	670,000	402,000	55	6.6	345,000	23	2,255	1,655	27	51
	730,000	438,000	51	6.1	354,000	21	2,379	1,779	25	50

Another question that might arise is the relation of additional developments on the Tennessee to the general power requirement of the Southern territory, on the assumption that any power not needed for nitrate operation will be disposed of in the southern market. The five Southern States—North Carolina, South Carolina, Alabama, Georgia, and Tennessee—have had an increase in power requirements of about 200,000,000 kilowatt hours per annum for the last 10 years. If that figure is correct, or approximately correct for the future, the power available at Dam No. 2, hydro alone, after meeting the full requirements for nitrate operation at nitrate plant No. 2, would carry this demand for two years, with a 240,000-horsepower installation. It would carry it for six years if the installation is 480,000 horsepower. If you add to the hydro power from Dam No. 2 the steam power available from the steam plants, a 240,000-horsepower installation at Dam No. 2 would carry the southern demand for six years into the future, and a 480,000-horsepower installation would carry it for 10 years into the future.

The CHAIRMAN. If we install 480,000 horsepower, that means that would be secondary, would it not? Dam No. 2 will not make that much.

Mr. MERRILL. With Dam No. 2 and the steam plant both operating, the primary combination from the two is about 230,000 horsepower.

The CHAIRMAN. Yes. Well, then, what do you demonstrate by saying if we installed 480,000 we would not be able to use it after we had installed it?

Mr. MERRILL. If you install 480,000, your maximum daily average is only 360,000 on a 75 per cent load factor basis.

The CHAIRMAN. To make power and supply the increasing demand of the country that you are talking about, it would have to be primary power, would it not?

Mr. MERRILL. Very likely primary.

The CHAIRMAN. You could not count on secondary power for general purposes, could you?

Mr. MERRILL. Of course, these figures that I have given of the years ahead that this one dam, plus the steam plant, would take up the demand leaves out of consideration the fact that other plants are being built in that territory also. This, however, is the conclusion that I would reach. On the basis either of providing power for operation of nitrate plant No. 2 or for having a surplus to meet the probable demands in the near future in the general southern mar-

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ket, there is no need at the present time of considering development beyond the development of Dam No. 2.

The CHAIRMAN. Now, ought we not to consider, if we were going to make development by the construction, let us say, of Dam No. 3, that that of itself would attract enterprises that would call for more power and that instead of comparing it on the increase of the past you would have to take into consideration the fact that the very development itself would bring in industries, so that it would probably increase at a much more rapid rate?

Mr. MERRILL. That is quite probable, that this rate of 200,000,000 kilowatt hours per annum would be increased, but it would not be the part of wisdom to put in a heavy investment in Dam No. 3 when you had the prospect of having to wait for five or more years before you could utilize your full developments at No. 2.

The CHAIRMAN. Oh, I agree with you that we ought not to go too fast. We ought to take that into consideration, I think. There is no use developing power that will not be used.

Mr. MERRILL. If you were handling the matter from a business proposition you would have your costs very materially increased by your interest on idle investment while waiting for your load to develop.

The CHAIRMAN. I would like to get your views on this. To my mind it is very important. We could very well develop Dam No. 2 and let other power dams alone and let private industry take it up and let them take it up as they saw the need of it, as they probably would, and there would be some use for it, but the question of storage reservoirs that you mentioned a while ago, covering such a large scope of country, it seems to me almost necessary to be taken up by the Government, in order to make not only Dam No. 2 but the other dams that may be constructed in the future more attractive as a development proposition and cheapen the power very materially.

Mr. MERRILL. I do not think it is necessarily true that the Government must put in these storage reservoirs even if they are quite expensive The time will come, if there is enough development on the Tennessee—when Dam No. 2 and Dam No. 3 are built, we will say—when probably the cheapest method of adding to the power at those sites would be by the development of storage, a method which would require only the installation of additional machinery at those two sites to develop additional power, rather than going elsewhere on the river to build a dam merely to get head. But the question of when you can economically increase your power at sites such as the Tennessee has by the development of storage is dependent upon the relation between the total head at the several sites and the cost of the storage reservoir.

The CHAIRMAN. Oh, yes; it might be so expensive that it would not be a practical proposition. I admit that.

Mr. MERRILL. We have a provision in the Federal water power act, put in specifically to meet a situation such as this, if any concern is developing power on the Tennessee it will naturally develop storage just as soon as it can get more kilowatt hours out of a dollar in storage than it can out of a dollar in new generating plant. If there are several concerns operating there, they may, by acting together, find the provision of storage advisable for the group of plants much earlier than if each is acting independently.

The CHAIRMAN. Yes.

Mr. MERRILL. So we have a provision in the water power act that if one of a number of licensees of the United States builds a storage reservoir the annual cost of interest, depreciation, and maintenance on that reservoir shall be shared by all.

The CHAIRMAN. Yes.

Mr. MERRILL. That was deliberately put in the act so that a concern which could not afford to build for its own purposes these costly storage reservoirs might afford to do so if they could have the annual cost distributed between themselves and other users.

The CHAIRMAN. Still it leaves it so uncertain, to my mind, it seemed to me very doubtful whether a private party owning a dam on the Tennessee would go up on the tributaries and construct storage dams. They would first have to put up the money, and it would take a good deal of money to do it, and the amount that would be contributed by other people would be uncertain, and they would have to bear the entire cost and depend on getting their money back from other people in the future. So I have doubted very much, unless it was some very attractive proposition, whether a private party would do that, or whether he could afford to do that, considering it solely on a financial basis, as they

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would consider it. Now, that being true, if there are possibilities of storage dams up there—of course, if there are not, then we are through—but if there are, at reasonable cost, and since the Government itself is interested in the biggest dam of all that will ever be constructed there, it seemed to me very appropriate that the Government should do that, it really being the only party that could afford to do it, and then get contributions under the law from parties who use the water.

Mr. MERRILL. I would very much rather see the Government—I think it would be very much more appropriate for the Government, if it were making any development at all on that river or spending any money for power purposes, to expend it in storage reservoirs which would increase the power of the river, and where there would be no complications of Government operation, than to build power dams and power houses and have matters complicated by the necessity of Government operation.

The CHAIRMAN. You may be entirely right. Of course, at least there are a good many good arguments that can be offered to that. But I was trying to bring you to that point about the storage reservoirs. I may be wrong, but to my mind the storage reservoirs on the Tennessee River will probably never be developed if we wait for private parties to do it, for the reasons that I have outlined. I hope I am wrong about it, but it does not look to me as though it is an attractive proposition for a private party to do it.

Mr. MERRILL. Major Burns, are they not developing storage reservoirs now on the Little Tennessee?

Major BURNS. Not to my knowledge. Maybe the Aluminum Co. is doing something of that sort, but I don't know.

Mr. MERRILL. They had proposals, I know, for quite an extensive reservoir development on the Little Tennessee. What is that on the map up there?

The CHAIRMAN. I think, Mr. Merrill, that map is somewhat of a propaganda.

Mr. MERRILL. That is the Tennessee River Improvement Association's map, of course.

The CHAIRMAN. Yes; and I would like to ask Major Burns about that map. I have been intending to do it for a good while. Major, do you know anything about that map?

Major BURNS. No, sir. I was not here when it was talked about.

The CHAIRMAN. Do you know whether the dams indicated there on the map have been investigated, or what investigation has been made in regard to them?

Major BURNS. There has been no official investigation made by the Corps of Engineers. Colonel Barden testified that the district engineer at Chattanooga was now making a more or less general survey of the storage dam possibilities of all that region, but that he had not completed it as yet.

The CHAIRMAN. Now, Mr. Merrill, there is another thing I wanted to call your attention to about these storage reservoirs that to my mind is quite an important one.

Won't they become more expensive as time goes on? Can it not be done now cheaper than in years to come, when the general situation will be more fully recognized, and the country more thickly settled up, the country settled up more in the mountainous region, and the land which will be necessarily overflowed be bought up for speculative purposes?

Mr. MERRILL. There is always that possibility. The land is not likely to decrease in value, and the construction costs are not likely to decrease. I don't mean that they won't decrease below the war level, but the general curve of costs is more likely to rise than fall; nevertheless you have to offset against that possibility the certainty of heavy carrying charges if you develop your storage reservoirs before the time they are needed.

The CHAIRMAN. Yes; but assuming we should go ahead now with Dam No. 2 that we are constructing, we would get some benefit out of it right away. They could not get those constructed before Dam No. 2 would begin to operate and we would begin to get some benefit right off, and other private parties that had dams there—and there are several—would be liable for their proportionate part of the expense. So we would get some direct benefit and we would get some contribution.

Mr. MERRILL. Do you feel certain of that from a legal standpoint that the people who are now on the river——

The CHAIRMAN. No; I would not say that I am certain about it. I think there is a very serious legal question involved in it. But that brings us to another proposition, Mr. Merrill, that the very uncertainty, it seems to me,

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makes it extremely important that the Government should enact a law that would apply particularly to the Tennessee River and at least prevent all doubt in the future about anybody going in there and getting the power. We can easily do that.

Mr. MERRILL. You can well enact a law that would apply to all navigable waters, that anyone building on that stream after the enactment would be——

The CHAIRMAN. I think we did that in the water power act.

Mr. MERRILL. That applies only to licensees. I should add, however, that nobody can go ahead in the future on a navigable stream and develop without being a licensee of the Government. Therefore, the provisions of the Federal water power act, to which I have referred, affects all future development on navigable waters, whether the headwater improvement is made by the United States or is made by a licensee of the United States, but it applies only to the payment of a proper share of certain specified annual charges and not to original construction costs. But, generally, Mr. Chairman, I wish to present it as my opinion that, unless the United States proposes at Muscle Shoals, either itself or through some agency, to develop nitrates in excess of the capacities of the plants now there, Dam No. 2 will more than supply its needs with hydropower alone, while with the steam in combination it will very much more than supply its needs; that, therefore, there is no occasion at the present time for proposing any development at No. 3 or others on the river for purposes of nitrate operation; that the probabilities are that the additional power from Dam No. 2 and from the steam plants in excess of the requirements from nitrate production will carry the load that should be properly assignable to the Tennessee for general distribution purposes in the southern territory for quite a number of years in the future; and that on this basis also there is no occasion at the present time for developing either Dam No. 3 or other powers along the river.

The CHAIRMAN. What did the Government have in view when it started in at Dam No. 3? Do you know? We have spent considerable money there already.

Mr. MERRILL. I can not say. There was one purpose in addition to the power, which it had in view, and that was navigation and that purpose, of course, we have now. Yet with the completion of Dam No. 1 and Dam No. 2 you will not have your navigation all the way up the river.

The CHAIRMAN. No; but it will make it better.

Mr. MERRILL. It will make it much better.

The CHAIRMAN. It will improve it very much, as far as it goes.

Mr. MERRILL. It will extend it beyond the point where it is now and make it very much superior to what it is now in those small canals along the side.

The CHAIRMAN. And outside of the maintenance of the locks it would be practically a permanent thing in navigation.

Mr. MERRILL. Yes.

The CHAIRMAN. As permanent as the dams themselves. It would not need any dredging or anything of that kind.

Mr. MERRILL. Assuming that Dam No. 2 is developed and assuming for the moment that it is developed by the United States, the question arises what disposition is to be made of the surplus power. If the Government develops the dam it might lease it for private operation and retain for its own use the 600,000,000 kilowatt hours necessary to operate nitrate plant No. 2; or it might operate the plant directly and sell the surplus power in the general market. If it does the latter it means, of course, the Government going into business. It means the construction of transmission lines, either by the United States into the territory south of Muscle Shoals, or the extension of their lines by existing distributing companies in order to take the power from Muscle Shoals; or the construction of lines by communities that may be direct purchasers of the power. I spoke the last time I was here of the undesirability, in my opinion, the extreme undesirability of confining this power that may be developed on the Tennessee River in the vicinity of Muscle Shoals to that immediate territory. I said that I believed it ought to go into the general power system of the South and be available for all the people in that great territory rather than for the benefit, even, of an extensive industry in the vicinity of Muscle Shoals itself. Now, I assume that the United States——

The CHAIRMAN. Now, might I interrupt you there? If you do that and provide that it shall go into general industrial development of the entire country rather than development of local commercial establishments that will be con-

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structed, that would mean that the present network of lines that connect up with them, which would be the most economical way to do, no matter who owns them, would be very greatly extended. They could reach down to New Orleans.

Mr. MERRILL. They could reach to New Orleans if there is a sufficient block of power to go into the system.

The CHAIRMAN. That bears again upon your proposition that we have power enough to last for several years without any more power developed in that vicinity. If the system were extended, for instance, if it took in New Orleans and the territory intermediate, assuming that it reached as far as New Orleans, with all its industries, it would make wonderful demand for power, would it not?

Mr. MERRILL. That would increase the demand very materially. It would probably increase it 50 per cent.

The CHAIRMAN. And is not that a practical thing?

Mr. MERRILL. I think it is.

The CHAIRMAN. Well, is it not extremely probable that if this power is developed at the Tennessee River, New Orleans and all the surrounding country will be included in this territory and supplied with electricity?

Mr. MERRILL. It is if there is a sufficient block of power available from Muscle Shoals to do that, and if it can be secured under conditions that will permit. If it were developed by the Government it would have to be sold under very long term contracts because there would be tens of millions of dollars worth of investment to utilize it.

The CHAIRMAN. Certainly. That would be true no matter who supplied it, would it not?

Mr. MERRILL. Yes. And if it is developed by a lessee of the United States, the same development or same investment, of course, goes in.

The CHAIRMAN. Yes.

Mr. MERRILL. The point I have is that the conditions under which the power is sold, if generated by the United States, should be comparable to the conditions under which properties would be leased for construction by another.

The CHAIRMAN. I don't know that I just get that.

Mr. MERRILL. That is, it would require to be long-term arrangements.

The CHAIRMAN. Yes.

Mr. MERRILL. Just the same as we have a long-term arrangement where moneys are put into the development of the plant itself under the Federal water power act.

The CHAIRMAN. Yes. I think that is quite true. As a matter of common justice, now, to the people of the United States, is not that what ought to be demanded by Congress in power development on navigable streams, rather than to give to some individual or a set of individuals, or a little community an advantage over every other individual, or an advantage over every other community that gets its advantage by the utilization of something that belongs to the entire people of the United States? Why should it not be spread out as much as possible and give as many people the benefit of it as we can?

Mr. MERRILL. I most emphatically think it should.

The CHAIRMAN. That is what I think.

Mr. MERRILL. Now, my general conclusion with respect to the situation down there is this: That whether the Government itself does or does not complete the development of Dam No. 2, it should reserve for itself the amount of power necessary to operate the nitrate plant; that it would be doing that practically as a measure of war insurance, to maintain in condition a plant for the production of nitrates in case we should get into war in the near future, or until such time as other processes or other plants are developed elsewhere, so that there is no longer the necessity of the United States doing so, and that it should limit its operations to that.

The CHAIRMAN. I might be able to compromise with you by ——

Mr. MERRILL. Perhaps I have not made that statement clear. It should limit its operations with respect to nitrates to what can be done with plant No. 2, and whether it wishes as a peace measure to go into the production of fertilizers by the use of nitrate plant No. 2 is a matter of policy for Congress to determine, but if it does it should not expect to make a profit; it should endeavor to produce them as cheaply as it can, of course, but it should frankly adopt the proposal that it is maintaining this investment here as war insurance, that it is making the best utilization of it that it can during peace times, and if it does not make a profit, well and good. As far as the power end is concerned,

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the Government itself should either do one of two things: It should either lease the property as it stands or it should complete it and then lease it. I do not believe the Government should go into the operation of the plant there and go into the business of selling power. Personally, I think with no very serious modifications, the offer presented to you by the Alabama Power Co. furnishes a very good solution of the handling of the power end, on the assumption that the United States proposes to maintain nitrate plant No. 2, proposes to hold title to it, and proposes to operate it itself unless it can make better arrangements. I would substitute, if the matter came to me, for the 100,000 horsepower, which is rather an indefinite matter, since it is secondary power, a statement in terms of kilowatt hours, and I probably would say that since nitrate plant No. 2 would require for maximum-production purposes 600,000,000 kilowatt hours per annum, the United States should have the second 600,000,000 kilowatt hours as an offset to the interest charges on the $17,000,000 of Government money now invested in Dam No. 2, and that in other respects the lease of the dam should be handled precisely as it would be handled in any other proposition on a navigable river, under the provisions of the Federal water power act.

The CHAIRMAN. Now, that would eliminate plant No. 1, would it not?

Mr. MERRILL. Now, with respect to plant No. 1——

The CHAIRMAN. That is not so important so far as its capacity is concerned, but as far as the improvement of the extraction of nitrogen from the air and that development is concerned, which is very desirable both as a war and peace proposition, No. 1 becomes, I think, quite an important factor.

Mr. MERRILL. I would think it would be quite desirable to retain plant No. 1—the title would be retained under this arrangement—and to maintain and operate plant No. 1 for purely experimental purposes, because I think that if the Government itself, or through an agent, goes in at Muscle Shoals in the production of nitrates, one of the purposes it should have constantly in mind is experimentation in the development of new processes.

The CHAIRMAN. It would be a serious mistake if we let down now and did not try to improve the process that everybody admits is in its infancy, and if it could be improved it would be a wonderful thing in the fertilizer line and also as a war measure.

Mr. MERRILL. There are several reasons why, in my personal judgment—and I went into this somewhat the other day when I was up here—the Government should not go into the business of manufacturing and selling power. The primary reason is that Governments are political organizations and not business organizations. They necessarily are such. They have been created to reflect the political ideas and to carry out the political policies of the people, and from the very fact that they are organizations of such character, business operations, when conducted by Governments, can seldom, if ever, get away from a certain amount of politics. And when I say politics I do not mean partisan politics. Even the provision of the bill that you have here, by which the directors are appointed by the President, with the advice and consent of the Senate, and hold office during life or good behavior, and are presumably removable only by the President on charges of misbehavior or by a concurrent resolution of the Senate and the House, do not mean that that is the only way that they can be gotten rid of, because the legislation could be amended and there could be substituted for the "board of directors" a "board of managers," thus legislating the original appointees out of office. That, as you probably know, has been a frequent procedure under State legislation for getting rid of administrative officers who could not be legally removed otherwise. I believe that the State of New York has offered an example of that sort of procedure, and that the State of Illinois recently, in order to dispose of its public utilities commissioners, created a State commerce comission, thereby legislating the old commission out of office.

The CHAIRMAN. The thing that brought about the demand for the change in those cases was that the old officials had run the thing into politics, was it not?

Mr. MERRILL. I suspect the reason is largely this—and there have been instances of it, particularly in the last few years—that the public thought that public service commissions were established only to reduce rates, and when the situation came about of the extremely high prices and costs brought upon public service corporations by the war, and the commissions started to raise rates to meet that situation, there was a public clamor in opposition to the action, and many a State public utilities commission has had a very difficult situation to meet. Some of them have not escaped the storm. Some commissions have

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been abolished or their members removed, while in other cases they have succeeded in weathering the storm. The public as a whole has not yet realized that public utility regulation means increase of rates, when necessary, as well as decrease of rates.

The CHAIRMAN. Those comparisons you have given, to my mind, would not be fully applicable, at least down here, because the instances you have cited are those in which the public service commission was dealing with the rates in which all the people were coming in direct conflict every day. That is not true down here.

Mr. MERRILL. You are intending here by your board of directors to fix the price of fertilizers not only for those of its own production but for those produced by others from the products of Muscle Shoals.

The CHAIRMAN. The fertilizer costs, if they were increased as far as the power is concerned, they never would be materially increased as long as there was no accident to the dam or something of that sort, because, regardless of railroad rates, the water would tumble down over the dam just the same when prices were high, and it would not cost any more than when prices were low. It would be something, it seems to me, that it would be so easy for anyone to see whether there was a manipulation there. It would not be connected up with a system of railroads or a dozen systems of railroads that are so complicated that the ordinary person in a lifetime would hardly be able to understand all their intricacies. If they raised the price of power that they sold, for instance, it would be a very easy thing to tell why in such a way that everybody could see it, and as to whether they would raise the price of power when other things went up, it would not follow, because the main thing in making the power is the water-power development, which is not affected by the price of labor or of steam or of coal, only in a limited degree.

Mr. MERRILL. Not to any material degree. Only to the extent that they might be using that steam plant would they be affected by it.

The CHAIRMAN. Yes.

Mr. MERRILL. But I think that the chief reason why Government business operations do not seem to succeed——

The CHAIRMAN. Is it not true that the people demand decreases or object to increases in rates to a great extent on account of manipulation by private individuals that affect the costs—private individuals and private corporations?

Mr. MERRILL. Because they think they do.

The CHAIRMAN. Yes. That is a historical fact in the railroads, for instance, that thas has been true from the beginning of the railroads down to the charge just recently made by the Interstate Commerce Commission against the Pennsylvania. Although it has been said in the past few years that all those things were past and the railroads did not do it any more, the Interstate Commerce Commission, in the case of the Pennsylvania Railroad and one other railroad, have claimed, at least, that they had practiced deception on the Government to the amount of six or ten million dollars.

Mr. MERRILL. In contracting out their repair work?

The CHAIRMAN. Yes.

Mr. MERRILL. Yes. There has been a corporate history in the past that present corporations, no matter how well they are conducted, have not been able to live down.

The CHAIRMAN. And in a great many instances their conduct to-day is such that they can not expect to live them down.

Mr. MERRILL. I think the greatest handicap in the Government handling business operations is its attitude toward its personnel.

The CHAIRMAN. I don't disagree with you, Mr. Merrill. I think there are some serious difficulties. For instance, speaking of getting into politics, now, I don't know of any railroad of any magnitude but what has been in politics more or less, and sometimes to such an extent that they have absolutely controlled an entire State, an entire legislature, and had a very material influence on the selection even of the United States judges, and all such things as that. They have been in politics all their lives. They are still in.

Mr. MERRILL. You are probably well aware that in the State of California the railroad company for a long time practically owned the State. It did when I first lived there. It lost it later.

It is my personal judgment, with respect to operations of a business kind, like the development and sale of electric energy, that unless the Government can not make a reasonable arrangement with others it should not undertake

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to go into the business itself; that it is not for the best interests of the ultimate consumers of power, because it is not likely to result in the development and production of power at as low a cost as properly regulated private capital can do it—and, of course, I stress "if properly regulated."

The CHAIRMAN. Do you know of any instances—and I am not saying there are none; I would like to study them if there are—where, in Government operation of any public utility anywhere, the officials that have had charge of it have been as completely removed from partisan political influence as the officials of this governmental corporation set up in this bill?

Mr. MERRILL. No; except in Ontario.

The CHAIRMAN. I was speaking of the United States.

Mr. MERRILL. Not in the United States. But, of course, you come back to this situation, that even with your bill there have to be moneys expended, there have to be appropriations from Congress to carry this work forward, and these operations are bound to come before Congress every time an appropriation comes up, and any questions that relate to the price of the product and the disposition of the product are going to be brought into the consideration of whether this appropriation shall be granted or not and what restriction shall be put on the appropriation; and it is the restrictions that are put on it, more than anything else, that militate against a business operation by the Government.

The CHAIRMAN. My idea of the corporation would not be that it would require governmental appropriation to carry on its business.

Mr. MERRILL. It would for construction purposes.

The CHAIRMAN. Yes. The bill that I have introduced does not permit this corporation to construct, as it is now. It might be desirable to change it, to turn that over to them. However, it did not do it in the bill. But it could easily be arranged so that they would be as independent of Congress, unless Congress should change the law, of course, as a private individual would be. I wanted to do that. I wanted to put it in such a shape that it could be just as free from governmental influence as a private individual would be, or a private corporation.

Mr. MERRILL. I think you have gotten as far in that way as possible to go, but I do not think it is possible to make it free from such consideration or from such influences as I have mentioned.

I wish to speak just briefly about the particular arrangement proposed in your bill. I believe if it is ever possible for the Government to conduct business operations on business methods it will have to be through a corporate organization. It will have to be done by an organization to which Congress is willing to grant adequate authority and responsibility and which will act in the same relation to Congress as the managers of a corporation act to its board of directors. The three members that you here call the board of directors are not in fact the board of directors. The real board of directors of this operation, like every other Government operation, is the Congress of the United States. They occupy the same relation, in my judgment, to the executive branch of the Government, or a parallel relation, that the board of directors of a business organization bears to its executive officers.

I don't know whether your measure proposes that the three directors shall have equal authority in management of the business. If so, I would doubt its advisability. I think there should be a group of men, whether three as proposed here or more, whose business it shall be to determine the general policies, the general lines under which the operation should proceed, etc., but that when you get down to actual administration you should concentrate the authority in an individual and make that individual responsible to the group that establishes the policy.

The CHAIRMAN. I may not have expressed it properly, but the bill is only tentative anyway. That was my idea. For instance, I did not conceive now that the President, in appointing these members, should necessarily select a chemist who would know about nitrogen, or select an engineer who would know about the control of the dam or its construction, or select a man who was familiar with the sale of power and has experience in that line, but that they should be broad-minded men who would be able to declare a policy, and in the experimental work they would employ chemists; they would employ engineers; and they would employ a business salesman, perhaps, in some other line. I don't believe the board of directors managed by experts, one of them a chemist, another an engineer, would be successful perhaps. I notice the great railroad corporations and other corporations are not operated that way. Great corpo-

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rations are not organized that way. The men who are the board of directors and select the president and select a manager or superintendent, select those men because of particular qualifications they possess for the kind of work they want them to do. But still they have general administrative control over them all the time.

Mr. MERRILL. The point, I think, is merely this: That when policies have been established and it is up for decision whether this thing shall be done or that thing shall be done or another thing shall be done to carry out the policy, it should not be a matter that would have to go before a board meeting for decision. There should be one man with authority and responsible, a general manager, we will call him, of the whole undertaking, responsible to the board of directors, and who will have full authority to execute the policies of the board itself. For example, to have every work order O. K'd, every expenditure O. K'd.

The CHAIRMAN. Oh, no. I would not want to do that. That is not my idea at all.

Mr. MERRILL. I have, personally, great doubt whether you can get a man of the character to do that under the salary limitation fixed in your bill.

The CHAIRMAN. That seems to be more or less the universal opinion. Maybe that ought to be increased.

Mr. MERRILL. If not, you will be likely, in my judgment, to get inexperienced men, therefore men not properly competent to handle the proposition. Or you may be able to find men who have private means and to whom the salary means nothing, who will accept the position.

The CHAIRMAN. That, of course, I think is an objection that is serious and ought to be considered. It, however, can be very easily remedied. I do not believe that we necessarily have to have men with great big salaries in order to do good work. I may be wrong about that. For instance now—I think I can say this without any embarrassment, because nothing of that kind, of course, will ever come to me—I feel without, I think, being at all egotistical, that I could serve as a member of the board of directors of that corporation and do good work, and I would have a chemist in whom I had confidence, and if he said, "We need $100,000 expended here," I would be for it. I would depend upon his judgment, and when I got so I could not depend upon his judgment I would discharge him and get somebody on whom I could depend. I would know the object I wanted to accomplish, and I should try to get the men who were competent to accomplish it.

Mr. MERRILL. That may be true in your individual case, and it is true in other individual cases, but I think one of the greatest dangers in Government operation is the belief that it is a saving of money to get low-priced employees. It is a serious mistake to ignore the competitive phases of personal service. You would not for a moment think of going out and buying a product for Government use and saying that the outside price that you will pay is one-third of the market price, because you know if you do that you will get a product that probably is not worth even one-third as much as the product that you want; but yet we seem to proceed constantly on the basis that we can do that with personal services.

The CHAIRMAN. I don't think it is quite fair to compare personal service with a commodity. I don't believe that is a fair way to judge labor, either.

Mr. MERRILL. I am not classing labor or personal services as a commodity when I insist that the Government can not secure either at one-half to one-third the prevailing rate any more than it can purchase commodities at any such a discount from prevailing prices. The Government, in fact, pays the prevailing rates for labor—when it doesn't pay more—but it has never paid more than a fraction of the prevailing rate in its highest grade technical and administrative positions.

The CHAIRMAN. There is the human element in it that has to be considered. I have observed, in my investigations, for instance, in certain railroads, men have been employed getting as high as $50,000 a year to manage a railroad, and about the only managing they do is to manipulate finances, issue a lot of bonds, organize some subsidiary companies, and bleed the railroads while they were making millions. A $50,000 man or a $7,000 man doing that kind of business would be getting more salary than he ought to have; and a lot of these high-salaried men are doing that kind of thing.

Mr. MERRILL. From my personal observation here in some 8 years that I have been in Washington and 12 years in the Government service, I do not

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believe that there is any other one factor that is so much responsible for such inefficiency as exists as the low salaries paid to those in responsible positions.

The CHAIRMAN. I think in lots of cases that is true.

Mr. MERRILL. I have seen hundreds of cases in the last few years, and know of hundreds more, of the best qualified men in the Government service leaving because they could not afford to work at the salaries they were paid, and they could get salaries three or four times as large outside. The result is that the best men leave the service of the Government and the poorest remain.

Now, with respect to the powers that have been proposed to be given to the board here, I have some doubt as to the advisability of granting any power to regulate fertilizer prices of other people, for this would mean that the board would be regulating the prices of its competitors. Particularly, I think it would be undesirable to give them authority to regulate the rates at which any power they might sell should be disposed of by the purchaser. First, it is a matter that is within the functions of the State public utilities commissions; second, if there is no State public utilities commission, then the board is hardly constituted for the quasi judicial action that would be required for the exercise of such regulation. If the board is going to do anything along this line, I think it would be better to place a maximum resale price on the fertilizer ingredients or products purchased from the board.

The CHAIRMAN. I rather think that would be an improvement to it myself. I think you understand the object I had in doing that.

Mr. MERRILL. I understand.

The CHAIRMAN. We want, if we can, to prevent the consumer of fertilizer from being imposed on by a combination or a monopoly, and all those regulations were put in to meet that situation. The suggestion you make I think is a very good one, about controlling the retail price, but I think there ought to be some regulation. Here is something that is brought about by the development of something belonging to the people of the country, and it ought not to be permitted to exist in such condition that, after all, a monopoly might buy all the product and then hold the people up for it. If that were the case we would have accomplished nothing. In other words, the consumer of fertilizers, if we are going into the fertilizer business and making it out of a Government thing, like Government water power, is the man we are trying to protect. The other fellows can protect themselves. The object is to get fertilizer to the consumer at a fair price. Otherwise there is no use going into it. If we stop in the middle and let a middleman buy the Government's supply and then sell it at whatever price he pleases to the consumer, we have not accomplished anything except to give the middleman an opportunity to become a millionaire.

Mr. MERRILL. I think that in order for the board to begin operations it will have to be given an appropriation for working capital.

The CHAIRMAN. I think that is true. It might be given working capital without an appropriation, I think. For instance, I have thought of authorizing it to sell the interest that the Government has in the Gorgas plant, a thing that I think the Government ought to get rid of anyway, and use that as capital, and to permit it to sell power and utilize that as capital.

Mr. MERRILL. I think there are certain obligations that should be placed upon this board. I don't know whether it is necessary to provide it by legislation or not in order to be assured that the procedure will be followed out. I think the board should be required to maintain a system of cost accounts which shall keep full record of all costs of operation, including interest on investment, maintenance, and depreciation, set up so that you will know at all times whether in fact the operations are proceeding at less than cost or at a profit, and so that any essential fact in relation to this transaction can be found out.

The CHAIRMAN. I think that is a good suggestion. I had assumed they would do that anyway, but perhaps it would be a good deal better to put that in the bill.

Mr. MERRILL. It is not the practice in any Government organization—I do not know how it is with those who operate on a quasibusiness basis, like the Shipping Board and others—to keep a system of cost accounting at all. The accounting which is general throughout the bureau organizations is merely an accounting of appropriations and disbursements and is not cost accounting in any sense of the term.

Now, with respect to the investment that the Government has there: The investment in Dam No. 2 at the present time, which will be under the control of the corporation, and all new construction I think should be carried on its books at actual cost. I think it would be only fair, however, with respect to

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the nitrate property, that it should be appraised at its reproduction cost less depreciation and carried on the books at that figure, for the simple reason that this is one of the white elephants of war time and many more dollars went in there than would be necessary at the present time to reproduce the plant. I think it should enter on its books interest on the investment at a rate not less than the average rate being paid at the time by the United States on its outstanding bonded debt. I think it should be required in a system of accounting to maintain capital accounts with proper distribution charges between capital and operation.

The CHAIRMAN. What would you do with regard to the maintenance of development work? How would you charge that up—I mean experimental work?

Mr. MERRILL. That is an operating cost of the business.

The CHAIRMAN. Of course, we do not expect to get paid on that. Everybody concedes that there is going to be a necessity to spend a lot of money in experiments for the improvement of the nitrate proposition, and the Government will gain by that in a general way. The Government could afford to expend, and would, in carrying on its work in the Agricultural Department, spend millions of dollars for the purpose of developing a new method and cheapening a method of some particular thing that is in universal use and not think of getting interest on the investment or the money they spent in it. It would not be fair to charge that up and expect this plant to pay interest on it.

Mr. MERRILL. I would not expect the plant to pay a profit in any event.

The CHAIRMAN. No; and I would not either.

Mr. MERRILL. If I went in on this proposition down there, as I said before, it would be primarily as a war insurance, and, secondarily, to get the benefit out of it in peace time by the manufacture of fertilizers. I would do it as cheaply as I could and forget the loss, but I would keep accounts to know how much my loss was.

The CHAIRMAN. Yes; we ought to do that.

Mr. MERRILL. This experimental work I would keep in a separate account, but probably charge it against operating expenses, nevertheless.

There is a provision in the bill for turning over to the United States Army and Navy munitions of war—explosives. Those, under a proper accounting system, should be credited on the books of the company at certainly not less than cost; and if you are to maintain a proper operating capital for the company, it may be necessary also that the War Department or the Navy Department shall transfer on its books to this corporation the price or the cost value of the material transferred.

Those are only details, of course; but the idea that I wish to bring out is this, that if you start out on this basis—start out on the assumption that we will have a system of commercial accounting—it will show at all times what the status of the business is, regardless of whether it shows a loss or a profit.

Now, I think I have nothing more, Mr. Chairman, except merely to repeat that in my judgment the best solution of the whole situation is the retention by the Government of its title in nitrate plant No. 1 and No. 2, the continued maintenance and operation of at least No. 2, and probably of No. 1, as a war insurance and as a means of producing fertilizers in time of peace. If satisfactory arrangements can be made, it would be desirable to lease these properties rather than to operate them by the Government. If such arrangement can not be made, the nitrate properties should be held under an organization such as is proposed in this bill. The nitrate properties should be separated from the hydro properties, with this exception, that whether the Government develops the hydro properties or whether it issues a license to some one else, there should be reserved for the operation of nitrate plant No. 2 the second 600,000,000 kilowatt hours developed at Dam No. 2, and the Government should either sell or lease its steam plant at Gorgas and at nitrate plant No. 2.

The CHAIRMAN. Do you think it would be practical for the Government to retain Dam No. 2 and lease its steam plant at nitrate plant No. 2? They ought to be used in conjunction.

Mr. MERRILL. The steam plant and the hydro plant ought to be used together. If it operates Dam No. 2, it should under such conditions keep the steam plant at Sheffield and dispose of its interest in the steam plant at Gorgas.

The CHAIRMAN. Have you studied the conditions of the Gorgas plant as applied to the ownership of the property in the way that it is intermingled?

Mr. MERRILL. I have not been down there, Mr. Chairman. I can very readily realize what the situation must be with a single power plant, as I understand

it, with two units sitting side by side on separate foundations, supplied with steam from the same boiler, connected with the same switchboard, part of the same plant, and I do not believe that they could be separated without wrecking or scrapping the property that was taken away.

The CHAIRMAN. They never could be operated separately except on some kind of an agreement.

Mr. MERRILL. That is it.

The CHAIRMAN. In other words, they would be as difficult to separate as the Siamese twins.

Mr. MERRILL. Only with this difference, that when you separate the Siamese Twins they both die, and if you separate these twins only one will die.

The CHAIRMAN. It depends on how you separate them. If you separate them by taking one away, you have lost one entirely.

Mr. MERRILL. Yes.

The CHAIRMAN. And you may separate them by taking them both away, and in that case they would both die.

Mr. MERRILL. Yes. But it would seem to me that it is utterly impracticable to dispose of the Government's interest in the Gorgas steam plant to anybody except the Alabama Power Co.

The CHAIRMAN. It would seem that the Government ought to buy their interest or they ought to buy the Government's. I don't see any reason why the Government should buy theirs, because we have not now any particular use for that plant.

Mr. MERRILL. My understanding of the purpose of the contract, in the first place, was not to give the Alabama Power Co. a strangle hold on the Government's investment, but to get a grip on the Alabama Power Co. whereby it would pay a reasonable price for the properties that the Government did not want, so that instead of going on and disposing of war property as they have hundreds of times at from 5 to 10 or 15 per cent of the investment, this is a case of getting back the actual value of the investment.

The CHAIRMAN. How much have we invested in the Gorgas plant?

Major BURNS. At Gorgas we have invested about $4,000,000. In the transmission line connecting Gorgas with Muscle Shoals we have property that has cost an additional million dollars.

The CHAIRMAN. We have about $5,000,000 invested.

Major BURNS. With the Alabama Power Co.; yes.

The CHAIRMAN. That includes the power plant and everything?

Major BURNS. Everything; yes, sir.

Mr. MERRILL. In most cases where the Government has had property, it has had to dispose of it at scrap prices, and on that basis this would be about a hundred thousand dollars, but here is a situation where they certainly can get more than scrap value for the property.

Senator KEYES. Have we not an offer of $2,500,000?

The CHAIRMAN. We have an offer of $2,500,000, made to the Secretary of War, which he transmitted to us.

Mr. MERRILL. That is all I have to say.

The CHAIRMAN. Have you any questions, Senator Keyes?

Senator KEYES. No.

The CHAIRMAN. We are very much obliged to you. I have been very much interested in your suggestions.

Senator KEYES. I am going to suggest that it may be important to change Section VIII so as to include steam power as well as power developed by the dam, because it seems to me if you are going to sell power it will be connected up and operated as one entire power plant.

The CHAIRMAN. That is a good suggestion.

Senator KEYES. I should think you would want to provide so that it would include all the power.

The CHAIRMAN. The Secretary of Agriculture is working on some amendments that he wants to suggest. When he gets them ready I will call the committee together. No doubt there will be a great many amendments, some that I want to suggest myself, and we may think of a great many more before we get through.

(Whereupon at 12.25 o'clock p. m. the committee adjourned to 10.30 o'clock a. m., Tuesday, June 6, 1922.)

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MUSCLE SHOALS.

THURSDAY, JUNE 8, 1922.

UNITED STATES SENATE,
COMMITTEE ON AGRICULTURE AND FORESTRY,
Washington, D. C.

The committee met, pursuant to adjournment, at 10.30 o'clock a. m., in room 224, Senate Office Building, Senator George W. Norris (chairman) presiding.

Present: Senators Norris (chairman), Capper, Keyes, Ladd, Kendrick, and Heflin.

STATEMENT OF DR. WALTER GLAESER.

The CHAIRMAN. State your name and occupation for the record.

Doctor GLAESER. Walter Glaeser, general manager and vice president of the M. C. S. Chemical Corporation, 63 Paris Street, Newark, N. J.

The CHAIRMAN. What is the business of that corporation?

Doctor GLAESER. We are manufacturers of chemicals—pharmaceutical and technical chemicals.

The CHAIRMAN. How many factories have you?

Doctor GLAESER. We just have one.

The CHAIRMAN. Where is that located?

Doctor GLAESER. At 63 Paris Street, Newark, N. J.

The CHAIRMAN. What is the value of your outfit?

Doctor GLAESER. Well, I suppose about $100,000.

The CHAIRMAN. Have you made a study of the Muscle Shoals proposition?

Doctor GLAESER. Well, no, except what I have read in the papers and what I have had reported to me by my friends.

The CHAIRMAN. You desire to testify particularly, I presume, about the nitrate plant there?

Doctor GLAESER. No, sir. About utilizing the electric power at Muscle Shoals for the production of commercial fertilizers.

The CHAIRMAN. Oh, yes. We will be very glad to hear you now on that subject.

Doctor GLAESER. Well, I presume that I will have to tell you about the process that I have.

The CHAIRMAN. Yes. Go ahead in your own way.

Doctor GLAESER. May I read from a memorandum I have prepared?

The CHAIRMAN. Yes.

Doctor GLAESER. I'll give an introduction to lead up to what I have to say. This is leading up to the proposed project. Is it all right to read it?

The CHAIRMAN. Yes, sir. I don't want to interfere with you in any way. Just proceed in your own way.

Doctor GLAESER. The first Stassfurt potassium chloride was brought on the market in 1861 and replaced first the chloride of potash made from kelp. The manufacture of the latter was kept up by considerably increased selling prices of iodine. Experiments conducted with a view to obtain chloride of potash from the ocean were discontinued; so were all attempts to devise methods for the extraction of potash from feldspar. The Indian potash saltpeter was almost entirely eliminated from European markets, since it could not compete with the artificial potash saltpeter made from Chili saltpeter and Stassfurt potassium chloride by double decomposition.

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Treated according to Leblanc's soda process, potassium chloride can easily be changed to potassium carbonate. This artificial carbonate of potash has, however, not yet succeeded in replacing entirely the natural carbonate made from the ash of plants, the ignition residue from beet-root molasses, and the potash obtained from the sweat of sheep's wool. The consumption of carbonate of potash increases daily. Potash soaps and potash glass are again valued. Potassium carbonate, made from muriate of potash, forms the raw material for a large number of technically important potash salts. The principal importance of all potash salts, lies, however, in their extraordinary value as artificial fertilizers.

As Liebig pointed out, the plant needs potash as an absolutely necessary and essential foodstuff. The fertilization with potash salts has proved of great advantage in most of the civilized countries, not only for cotton, tobacco, potatoes, but also for orchards, grain, corn, grasses, and the lesser agricultural crops. The consumption of potash salts in this country, during the last 10 years before the war, reached enormous proportions. Here most of the potash is used in the fertilizer-industry, and practically all of the potash salts necessary are imported from Germany, which country exercises a monopoly, fixing outputs, prices, etc. Competition with Germany has so far been out of the question, and will be until a cheap process is devised for the commercial exploitation of the vast stores of insoluable potash locked up in feldspars and similar silicates. This can only be accomplished by means of a proper by-product which must have a considerable value itself, and in this way indirectly pay for the cost of extraction.

There exist to-day in the United States and Canada several rather unimportant sources of soluble potash salts and potash manufacturing establishments. The disappearance of our forests has greatly curtailed the production of potash from the ashes of wood. In Canada the carbonate of potash has been manufactured extensively, since that country abounds in forests. However, during the last 50 years a great falling off in the manufacture of the so-called "pearlash," has taken place. Scattered deposits of potash salts, on a diminutive scale, are said to have been located in California on Government land. The necessary litigation is pending to allow proceeding with the exploitation of these deposits.

A small amount of potassium chloride is obtained from kelp, a seaweed, on the Pacific coast. Cost of production must be extremely high and can be offset in normal times only by by-products, like iodine. Several saline deposits in the region of Great Salt Lake, Owens Lake, and Searles Lake Basins are being investigated for potash production on a cemmercial scale, but up to this time no commercial process has been discovered. The saline lakes in Nebraska are now being utilized, and, by concentration, potash salts are being obtained, but the product is low in K_2O content, and to produce a product comparable with the German muriate would not be practical. An extensive alunite deposit—impure basic potash alum—is being experimentally worked by a company with large capital. They seem to be making good progress, but it is doubtful if they will be able to compete with the German syndicate. A short time ago prospectors in the eastern part of California found small deposits of potash, alum, and sulphur. It is said that a company was formed to develop that thact of land. And so it goes on. The search for potash deposits continues in the West, and some day may be crowned with success, after millions of dollars have been spent in borings.

There are potash deposits in the United States if only some one would spend the necessary money to find them, because there are saline wells in Michigan and Texas and all over the Middle West, which carry more or less potash. These saline wells come from a potash deposit, you know. Where the deposit is we do not know, unless some one spends some money to find out.

The CHAIRMAN. You mean these saline wells indicate that there is a source of potash?

Doctor GLAESER. Yes. There are perhaps just as large potash deposits in this country as there are in Germany. The question is, Where are they? They are here. Practically every brine carries potash in water-soluble form, and these brines are flowing through some potash salt deposits somewhere. They may be a mile below the surface or they may be 5 miles away, so far as we know.

The CHAIRMAN. You mean that wherever there is one of these saline wells carrying small amounts of potash in solution it indicates that somewhere near source where it flows through there is potash?

ctor GLAESER. Yes, sir.

e CHAIRMAN. In probably large quantities?

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Doctor GLAESER. Yes; exactly so. In the meantime, even the smallest quantity of potash salts produced from the above sources in this country may act as a check on the German syndicate.

A comparatively small amount of soluble potash salts is collected from the flue dust of cement plants and blast furnaces. The machinery required is very expensive, calling for the installation of a Cottrell precipitator; this apparatus produces an electrostatic field which the flue dust traverses, the potash being precipitated on one of the poles. The precipitator is very efficient, but expensive to install and to operate, but at present prices for potash salts no doubt the investment will pay for itself. The Cottrell apparaus is in successful operation at Riverside, Calif., and at a cement plant located at Hakerstown, Md., and one near Easton, Pa.

Soundings in search of potash salts have been conducted in the Province of Belfort, France, but so far no results have been attained. Potash has been discovered in the thick layer of ashes covering the ruins of Herculaneum and Pompeii, and conclusion was drawn that the neighborhood around Vesuvius is rich in potash. On the border between Austria and Russia efforts are being made to exploit commercially the potash deposits appearing there as a by-product of the Galician salt industry; but it is somewhat premature to consider this as a possible competitor of the Stassfurt mines, even if they should prove a paying proposition. Of more importance in that respect are the discoveries of deposits of chloride and sulphate of potash in Catalonia, in Spain; but, naturally, their true value can only be estimated after a thorough practical investigation.

Both in this country and in Europe small amounts of potassium chloride and sulphate, respectively, are also derived from waste liquors of certain chemical plants and from sea water (Geddes, N. Y.). The amount is very insignificant, and is mentioned only as a matter of record.

On looking over the situation, as described above, critically, we must frankly admit that although some potash is actually being produced in this country and elsewhere, outside of the product of the Stassfurt mines the amounts produced are so small, and always will be, considering the nature of the raw materials employed and their comparatively limited supply, that at present all these various projects of obtaining potash and the numerous small enterprises actually producing potash from insignificant sources of raw materials can hardly be of any importance when compared with the enormous and much less costly production of the German mines, and the rate at which, especially, the United States consumes these potash salts. Very often, in spite of the gigantic German output, the demand in the United States for potash salts for agricultural purposes surpasses the supply, and therefore the German syndicate manifests no nervousness whatever in the presence of attempted competition, especially the competition which arose during war time, and confidently expects to continue dictating the prices to the rest of the world.

American farmers have asked themselves often enough, "What will we do if the supply of German potash salts, so essential to our prosperity and therefore to the prosperity of our country, is shut off, by a war, for instance?" This condition existed lately, and the United States was forced to pay exorbitant prices for a material which is needed so badly for her own commercial and agricultural development.

Waste water from chemical plants like tartaric-acid factories, you konw, carry potassium sulphate or chloride. These plants produce tartaric acid from argol. Argol has a good deal of potash in it. In order to decompose the potash you have to change the argol into tartrate of lime, which is done by treating the argol with calcium chloride, forming tartrate of lime and potassium chloride. The tartrate of lime is then decomposed with sulphuric acid, producing sulphate of lime and tartaric acid. The potassum chloride from the mother liquor of the tartrate of lime is allowed to run into the sewer. There is a great deal of waste of potassium sulphate.

Senator KENDRICK. Mr. Chairman, may I ask the witness a question there?

The CHAIRMAN. He has not said whether he wanted to be interrupted while reading this prefatory explanation.

Doctor GLAESER. Yes, sir.

Senator KENDRICK. I want to ask if you have the figures as to the difference in the cost of potash in this country during ordinary times and the price we paid during the war.

Doctor GLAESER. Yes, sir. I will get you that right away.

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Senator KENDRICK. All right.

Doctor GLAESER. But relief is in sight. The natural resources of this country are wonderful. Of course, it is necessary to know how to use them to best advantage. The United States abounds in feldspar and feldspathic rocks, and these minerals are widely distributed throughout the country. The State of Connecticut ranks first in the list of feldspar-producing States; Pennsylvania is second; then comes Maine, New York, Maryland, Massachusetts, Wisconsin, Virginia, Texas, North Carolina, Georgia, Minnesota, etc. These rocks have, among other constituents, a considerable percentage of potash; they are, therefore, a source of raw material from which potash can be extracted; and after a method has been devised, which will produce potash from these rocks in commercial quantities, and at an operating cost low enough to compete with the German product after the war, then these feldspathic rocks will form the main source of potash in this country. Liebig stated that in order to benefit the plants the potash must be applied in water-soluble form. The question arose, "Has finely powdered feldspar any value as a potash fertilizer?" The answer is "No." Numerous experiments were conducted by scientists all over the world, from the middle of the last century until this day, to test the availability of finely pulverized feldspathic rock, and to ascertain whether it would serve as plant food and potash conveyor. The experiments made by the United States Agricultural Department proved fertilization with ground rock alone a failure. Detailed experiments performed by the celebrated German chemist, Doctor Maercker, showed also, conclusively, that ground feldspar and feldspathic rocks were absolutely useless as fertilizers. While a slight percentage of their potash contents is ultimately rendered available to plant life by the action of nitric acid, ammonium bicarbonate, and the acids of the soil, the process is entirely too slow to benefit a given crop.

Methods for extracting potash from feldspar were suggested over 70 years ago by German, English, and French chemists, whose experiments were abandoned in undeveloped stages at the time of the Stassfurt discoveries. However, later, after the formation of the German potash monopoly, interest in the problem of procuring potash from feldspars was reawakened, as is proved by the great number of patented processes for the utilization of potash-carrying feldspathic rocks. Most of these methods are of little or no commercial importance. Some of them may show promising results in the elaboratory scale, but until the disassociation of potash feldspar can be successfully applied on a commercial scale we have very slight prospects of freeing ourselves from the yoke of the German potash monopoly.

German commercial muriate of potash, with 50 per cent K_2O, was sold before the war for about $40 per short ton, laid down at the Atlantc seaboard. One unit of K_2O (corresponding to 20 pounds K_2O) in form of chloride cost the American consumer approximately 80 cents at shipping points along the eastern coast.

Two years ago—in 1915—it was stated by American scientists, who had made a special study of the potash situation (American Fertilizer, Oct., 1915), that that feldspar extraction process will be commercial which can produce, in time of peace, one unit of K_2O in form of chloride at less than 60 cents. That assumption may have been correct at that time. To-day, considering the changed political conditions, this cost figure seems entirely too high; it should be about 48 cents, or even lower, for the simple reason that should Germany reduce the price of muriate from $40 to $30 per ton, which she can easily do, as the Stassfurt mines are not working at full capacity, all processes based on an operating cost of 60 cents per unit will have to be discontinued; whereas, at 48 cents per unit, or a manufacturing cost of $24 per ton of American-made commercial muriate, there remains enough margin to warrant competition.

At this stage another possibility may arise: In case of serious competition affecting her potash interests Germany, after the war, will undoubtedly try to reestablish her monopoly on potash salts by the simple expedient of dropping the price of the commercial muriate to, let us assume, $15 per ton, or 30 cents per unit of water-soluble K_2O. At this figure the German syndicate would not make any money, for the cost per unit of water-soluble K_2O in crude catnallit, which is one of the materials used, before the war was approximately 18 cents at the time. More than 6 tons of crude catnallit must be worked in order to furnish 1 ton of the commercial muriate; the cost of producing the concentrated article is high, and there is a loss of 15 to 25 per cent of potassium chloride in the operation.

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While the chances for a price reduction of the German commercial muriate to $15 per ton after the war are remote, the possibility exists nevertheless and should here be given due consideration.

It follows that the commercial feasibility of a process for the extraction of potash from feldspar is determined by these seven main factors:

1. The plant must be in close proximity to a large, fair-grade feldspar deposit.
2. The deposit should be near rail and water and situated in one of the agricultural States or near the agricultural belt.
3. The process must provide for continuous operation.
4. A large amount of feldspar must be treated daily.
5. A high percentage of the insoluble potash must be changed to the water-soluble state; that is, 90 per cent or more.

Most extraction processes never get more than 50 per cent.

6. The process must be devised so that a high-grade and valuable by-product is obtained, which will pay for the cost of treatment.
7. The operating cost per unit of water-soluble K_2O must be less than 30 cents.

Any process operating at a higher cost than 30 cents per unit of K_2O might just as well be discarded.

None of the processes classified below fulfill all of these seven requirements. They may be arranged in four groups, as follows:

1. Methods requiring treatment in autoclaves under high pressure. The operation is necessarily noncontinuous, and not only a small amount of spar can be handled daily. Machinery required is very expensive. Cost figures for heating and evaporation of a large volume of dilute liquors, as well as depreciation of apparatus, must be very high. These processes are not commercial, even assuming the decomposition of the feldspar to be complete, as a by-product; a cement material is obtained which has no special value.

2. Volatilization processes with cement material as a by-product. Material is sent through kilns where the conversion of the insoluble potash to the water-soluble state is said to take place. Most of the inventors claim to obtain an extraction of 80 per cent. The potassium chloride is volatilized and caught in the dust chamber and so-called stack washer.

If a chloride is used as a reagent, as indicated in the various patent papers, an extraction of 80 per cent as claimed is out of the question, for certain chemical reasons. If any extraction at all is obtained, it will be nearer 40 to 60 per cent.

The volatilization of the potassium chloride can not be complete, as this salt starts to volatilize around 900° C., and the temperature must be raised to about 1,600° C. before all potassium chloride is driven off. This means maintaining a temperature of nearly 3,000° F. in kiln, and to keep the goods at that temperature a sufficiently long time to insure volatilization of all potassium chloride which has been liberated. The by-product, cement material, is of doubtful value.

3. More or less complicated burning or fusion processes with cement material as a by-product. There are a large number of these processes, all of which work along the same lines. The feldspar is usually subjected to a preliminary heat treatment, either with or without the addition of chemicals. It is then in a condition to be mixed with other reagents, and the mixture is furnaced in kilns at high heat. None of these methods will give a high extraction, especially if a chloride is employed as the reagent, although one or two of the inventors claim to have obtained as high as 80 per cent extraction.

Then follows leaching with water or acids, or treatment with the electric current, etc., and finally evaporation. The only by-product obtained is a material fit for cement clinker, paper filler, or road material, having no fixed commercial value.

4. Electrolytic processes and methods based on the use of very expensive chemicals, like hydrofluoric acid, etc. These processes have only scientific value. Of European scientists who have made an exhaustive study of the decomposition of the feldspars, special mention may be made of R. A. Tilgham (1847); W. E. Newton (1856); F. O. Ward (1857); the German chemist, Dr. Dulla; J. G. A. Rhodin (1901); the Norwegian chemists, O. N. Witt and G. Jebson (1909); and the Swedish chemist, O. Ashan (1911), who was assisted by L. Lokka, E. A. Lahemius, and E Makinen.

Various reagents were employed by these inventors to effect the decomposition. Most of them used lime or salt, or mixtures of lime and salt. Ashar experimented with calcium chloride also and found that "acids do not seem

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to be suitable for the decomposition of feldspar. Of the other methods, only the one with calcium chloride and with lime and salt are worthy of attention, the former offering distinct advantages if calcium chloride be obtainable at a cheap rate."

Some promising results were obtained with the lime-salt method, so that the establishment of a factory in Sweden was contemplated—1901—with the main object of making the vast deposits of third-rate feldspar in the neighborhood of Stockholm useful for agricultural purposes, without giving any special attention to the production of a high-grade by-product.

Cost figures are available of only two of the processes discussed, and even these figures are largely based on assumption. They are much too high, anyway. One claims his operating cost per unit of water-soluble K_2O to be 59 and 61 cents; and the prospectus arranged by the promoters of the other process shows a trifle over 71 cents cost of producing one unit of water-soluble potash. Both inventors state that they will obtain an uninterrupted extraction of 80 per cent, and their cost figures are, of course, based on that assumption. Even if they did obtain that degree of efficiency of decomposition, their operating cost per unit, as pointed out before, is much too high to allow of successful competition with the German salts. As a matter of fact, since both employ lime and calcium chloride as reagents and carry the furnacing operation out in an open kiln and a blast furnace, respectively, it can be safely stated that it will be very difficult to obtain an uninterrupted extraction of 80 per cent, as claimed.

In summing up, it can be asserted with a fair degree of accuracy—the opinion being wholly unbiased—that none of the processes for the decomposition of feldspathic rocks, upon subjection to a critical examination as to their commercial usefulness, have shown their ability to enter into successful competition with the products from the German potash mines in normal times. The main reasons for their incompleteness or inefficiency, judged from the standpoint of commercial rivalry, are their high operating costs, low degree of extraction, and lack of a valuable by-product.

The process was devised with the idea of obtatining a valuable by-product which would pay for the total cost of operation. The experiments toward the perfection of a process lasted more than three years and were conducted successfully at three experimental plants, located at Naval Academy Junction, Md., Toledo, Ohio, and Fullerton, near Allentown, Pa. While the first two plants were erected only for the purpose of trying out on a comparatively large scale the reactions obtained in the laboratory in batches of several hundred pounds, the experimental plant at Fullerton was of semicommercial size, designed for the treatment of tons of material in a continuous operation. The extraction exceeded 90 per cent.

The process consisted of two parts, namely, the furnace treatment and the chemical part for the production of the by-product.

Calcium chloride is used as reagent in both parts, with or without the addition of a small amount of a suitable catalytic agent. In the first part of the process both oxygen and water steam are excluded, while in the second part the addition of water steam, in the absence of oxygen, plays an important rôle.

A large excess of calcium chloride is used at the beginning. All of this calcium chloride is regenerated with the exception of that amount which was consumed during the conversion of the insoluble potash to the water-soluble state.

All heat treatments are applied in specially constructed furnaces. The other apparatus needed is standard and, relatively, inexpensive. The steps of the process as worked out are as follows:

1. Liberation of the K_2O.
2. Separation of the potassium chloride from the excess calcium chloride by "steaming."
3. Formation of an amount of hydrochloric acid corresponding to the excess calcium chloride which was present in the mass to be "steamed."
4. Collection of the hydrochloric-acid gas evolved.
5. Utilization of the collected hydrochloric acid in the decomposition of an equivalent amount of phosphate rock.
6. Precipitation of dicalcium phosphate, or superphosphate (which is soluble in ammonium citrate solution) from the phosphoric acid liquor obtained).

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7. Reclamation of calcium chloride from the mother liquor of the dicalcium phosphate, the amount of calcium chloride regained being equivalent to the amount of this reagent contained in the mass to be steamed (see No. 3).

The feldspar-calcium chloride mixture—after receiving an inexpensive preliminary treatment—is sent through a specially equipped furnace, at such a rates of speed that the material will stay in the extreme hot zone about one hour. In this way an uninterrupted conversion of the insoluble potash to the water-soluble state is obtained. The material leaving the furnace is now reduced to a uniformly granular mass and fed into another special furnace, where it receives a second heat treatment at a temperature much lower than before, steam being blown into the furnace at the discharge end. Water may be introduced in form of a fine spray at this stage. By this treatment nearly all the calcium chloride present can be decomposed to lime and hydrochloric acid. The hydrochloric acid gas leaving this "steamer" is caught in a tower and a set of tourrills. The dilute hydrochloric acid obtained is used in the manufacture of citrate-soluble dicalcium phosphate (see note), while an equivalent amount of calcium chloride is regained, which is used over again.

The whole operation forms a complete circle as the following diagram indicates.

Here is a diagram. Here is a mixer, a dryer, first furnace, second furnace, acid tower, phosphate rock dissolving tank, superphosphate precipitating tank, then comes the evaporator. After taking out the muriate of potash and superphosphate, you have the calcium chloride to put back into the mixer and use over again.

Products obtained:

1. A commercial muriate of potash with 50–58 per cent K_2O, the 50 per cent goods having as impurity about 16 per cent sodium chloride and from one-fourth to 3 per cent calcium chloride. The amount of sodium chloride in the finished muriate depends upon the per centage of soda (Na_2O) in the spar used.

2. A superphosphate having from 40 to 52 per cent available phosphoric acid, the higher grade being theoretically dry.

3. A residue of a fineness to pass through a 120-mesh sieve and having a chemical composition similar to that of cement rock. This material has no fixed value.

NOTE.—The modern view of the alimentation of plant is based on Liebig's fertilizing theory, which is founded on the principles that the plant foods, either of an organic or a mineral nature, must be supplied in an available form to serve as nourishment for plant life. This means they must be in such form as to be readily assimilated by the crop to which they are supplied.

The principal elements for the growth of plants are potassium, nitrogen, and phosphorus. Potassium is that constituent which is essential for the formation of starch within the seed or the kernel of the fruit of the crop. Nitrogen promotes and regulates the growth of plants. Phosphorus is of the utmost importance for the ripening process and is found in largest quantity in the seeds and fruits. Lacking phosphorus, plants will have frail stalks. Lacking potassium (starch) and phosphorus (strength), the plant fruits (the crop) will be imperfect, small, and the yield will be light. Lacking nitrogen, the leaves of the plant will be "off color" and the growth will be stunted.

As soon as a crop is removed the soil is depleted of these important elements, which therefore must be replaced by artificial means in an available form. Potassium is readily assimilated only if it is introduced in water-soluble form, as a salt of potassium, like muriate, or sulphate, or carbonate of potash. Nitrogen may be supplied as water-soluble nitrate or as water-insoluble organic nitrogen (tankage, blood, fish, etc.). Phosphorus is applied in any of the following, either water-soluble or available, forms:

1. As acid phosphate, with 13 to 16 per cent available phosphoric acid, 80 per cent of which is water-soluble. This product is obtained by the action of sulphuric acid upon phosphate rock. About 2,000,000 tons of phosphate rock are used annually in this country in the manufacture of acid phosphate.

2. As double superphosphate, resulting from the action of phosphoric acid upon finely ground phosphate rock. This material is imported from Europe and contains about 40 per cent of phosphoric acid, which is either in the water-soluble or available state. It is used in the United States only to a limited extent.

3. As a concentrate "available" superphosphate or in the form of an electrolytically (Dr. W. Palmer, Norway) made, so-called diphosphate, having from

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22 to 23 per cent phosphoric acid, all of which is water-insoluble, but is soluble in standard ammonium citrate solution. This material is also imported from Europe.

4. As phosphatic slag, like the so-called Thomas slag, a by-product of the Bessemer steel process, carrying 17 to 18 per cent of phosphoric acid, presumably in form of tetracalcium phosphate. The phosphoric acid in this material is insoluble in water but gradually soluble in standard ammonium citrate solution. It must be ground very fine.

The degree of availability is practically the same whether acid phosphate, double superphosphate, or available superphosphate be employed. Experiments have indicated that the phosphoric acid or water-soluble phosphates is first converted to the "available" or reverted room as soon as it comes in contact with the bases of the soil, the juices eliminated by the plant roots afterwards dissolving this finely divided water-insoluble phosphate. It is different with phosphatic slag. This material is assimilated by plants very slowly, as its phosphoric acid is present in a comparatively insoluble form; nevertheless it is superior to untreated ground phosphate rock.

Over 4,000,000 tons of phosphatic material are consumed annually in the United States. This demand is steadily increasing with the agricultural development of this country. In fact, the agricultural development is dependent upon the amount of phosphates employed in the cultivation of the land.

Cost of producing one unit of available phosphoric acid, before the war, was in the neighborhood of 50 cents, with a selling price of more than 70 cents.

The dicalcium phosphate, produced under the proposed process, is obtained as a by-product. Its cost of manufacture is very low. There is a steadily increasing, enormous demand in the United States for a high-grade available phosphatic material. For this reason the advantage is readily seen of obtaining a high-grade "available phosphate" as by-product in a feldspar extraction process.

Cost of plant: The process is arranged so that it can be worked on a very large scale in a plant composed of units, each unit capable of taking care of 50 tons of feldspar per day.

While the cost of the 1-unit plant will be comparatively high, that of a 10-unit plant will be much lower in proportion. It is estimated by a reliable engineering company that the complete equipment, including buildings, for the first unit, would cost about $350,000, and that a 10-unit plant, capable of handling 500 tons of feldspar and approximately 400 tons of phosphate rock per day could be put in shape for operation at an expenditure of approximately $1,013,000; a "one-half unit" plant, not so complete in equipment as the one-unit plant, but giving continuous operation, approximately $135,000.

The estimates, of course, assume that the plant be erected in close proximity to a large feldspar deposit which must have railroad connection, and a tide-water location would be of great advantage.

The daily continuous production in a completely equipped 1-unit plant, as outlined above will be at least 9 tons of commercial chloride of potash, 50 per cent K_2O; 32½ tons of superphosphate, with 40 per cent available phosphoric acid, and 60 tons of cement material, of no fixed value. Total daily operating cost will not exceed $554.

This has been worked out very closely by the Fuller Engineering Co. of Allentown, Pa., a reliable concern, based on actual tests.

Value of 9 tons of commercial chloride of potash with 50 per cent K_2O, before the war	$360
Value of 32½ tons of superphosphate with 40 per cent available phosphoric acid	910
Total value of manufactured products at basis 1 unit water-soluble K_2O, 80 cents; 1 unit available P_2O_5, 70 cents)	1,270
Maximum total daily operation cost	544
Total daily profit at pre-war prices	726

Cost and earning in a one-half unit plant will be as follows:

Value of products obtained, based on peace prices	$635
Daily operating cost	342
Daily profit at pre-war prices	293

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In a 10-unit plant the net earnings are shown in the following manner:

Value of products obtained, at pre-war prices	$12,700
Daily operating cost	5,340
Daily profit at pre-war prices	7,360

It is readily seen that the potassium chloride obtained is free from any manufacturing cost, as the value of the superphosphate produced exceeds the combined cost of operation. It does not cost a cent in this combined process of operation. The value of the superphosphate obtained is $910 in a one-unit plant, and the total cost of operation is only $554, which makes the potassium chloride not only free from cost but introduces an additional profit of over $350.

This is still true should the selling price of available phosphoric acid drop to 42 cents per unit, although such a contingency seems remote. The potash would still be obtained free of cost if the value of the acid phosphate is 43 cents per unit.

It was stated before that in the determination of the commercial feasibility of a process for the extraction of potash from feldspar seven main factors had to be considered. The proposed process meets all these requirements in the following manner:

1. "The plant must be in close proximity to a large fair-grade feldspar deposit."

There are several large feldspar deposits right near Muscle Shoals.

2. "The deposit must be near rail and water and should be situated in one of the agricultural States or near the agricultural belts."

Several high-grade deposits of feldspar and other potash-carrying silicates are to be found in the southern part of the United States adjacent to rail and water.

3. "The process must provide for continuous operation."

The operation of the proposed process will be a continuous one.

4. "A large amount of feldspar must be treated daily."

The complete plant, as outlined, consists of 10 units, each unit capable of taking care of 50 tons of feldspar per day. The maximum daily capacity of the proposed plant will therefore be 500 tons of feldspar. If desired, this may be increased to 20 units or more on account of the vast extent of the deposit of feldspar, mica, sericite in the south locality.

5. "A high percentage of the insoluble potash must be changed to the water-soluble state; that is, 90 per cent or more."

Treated according to the proposed process, an uninterrupted conversion of more than 90 per cent of the insoluble potash to the water-soluble state is obtained.

These figures you can have verified at any time if you will ask Dr. Edward C. Worden, of Milburn, N. J., and Mr. J. B. Gaffney, of Allentown, Pa., to come here as witnesses. They can verify these statements.

6. "The process must be devised so that a high-grade and valuable by-product is obtained which will pay for the cost of treatment."

Dicalcium phosphate (superphosphate, with more than 40 per cent available P_2O_5) is the by-product obtained. All the phosphoric acid contained in that material is present in the available state, which means soluble in ammonium citrate solution of standard strength.

7. "The operating cost per unit of water soluble K_2O must be less than 30 cents."

The value of the superphosphate obtained covers not only the complete cost of manufacturing the potash as potassium chloride but in addition leaves a considerable surplus over the combined manufacturing costs.

The proposed process is therefore commercially feasible and capable of entering into successful competition with the German potash syndicate at any time.

The CHAIRMAN. You say the process you have outlined is covered by 14 patents. Who owns the patents?

Doctor GLAESER. The Potash Extraction Corporation of New York owns the patents.

The CHAIRMAN. They are all owned in this country, are they?

Doctor GLAESER. Yes; they are all owned in this country. They are all taken out here.

The CHAIRMAN. Are they new patents?

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Doctor GLAESER. Comparatively new. The oldest is about 4 years old. Some of them are still pending. I am keeping them at the Patent Office as long as I can.

The CHAIRMAN. Do you expect to manufacture by that process?

Doctor GLAESER. Not very quickly.

The CHAIRMAN. Why?

Doctor GLAESER. I want first to cast around a little bit to find out if some one would be interested in taking it up.

The CHAIRMAN. Does it require much power?

Doctor GLAESER. No; it does not take much power. It requires heat.

The CHAIRMAN. You need electricity?

Doctor GLAESER. It requires a lot of heat.

The CHAIRMAN. And you want to do that by electricity?

Doctor GLAESER. Yes, sir.

The CHAIRMAN. Have you examined the nitrate plant down there at Muscle Shoals?

Doctor GLAESER. No. I know only about this from newspaper reports and from statements of my friends.

The CHAIRMAN. You provide the potash?

Doctor GLAESER. I provide the potash and superphosphate, and somebody else provides the nitrogen.

The CHAIRMAN. It was your idea to operate this in connection with the extraction of nitrogen preferably by the plant down at Muscle Shoals?

Doctor GLAESER. Yes.

The CHAIRMAN. To combine the two?

Doctor GLAESER. Yes; and make a complete fertilizer.

The CHAIRMAN. And make a complete fertilizer?

Doctor GLAESER. Yes; and get your potash practically free and your acid phosphate much lower than it can be manufactured for in the usual way.

The CHAIRMAN. In making a complete fertilizer you have to get the nitrogen from the air, in the process down there?

Doctor GLAESER. Yes, sir.

The CHAIRMAN. You would then get the potash without cost?

Doctor GLAESER. Yes.

The CHAIRMAN. And the phosphate at less than present cost?

Doctor GLAESER. Yes; exactly.

The CHAIRMAN. Your by-products will be sold on the market?

Doctor GLAESER. Well, the by-products—there are not any other by-products to speak of.

The CHAIRMAN. How do you get your potash for nothing, then?

Doctor GLAESER. I stated that you assume the acid phosphate would be the main product. The by-product is a cement material, having no fixed value.

The CHAIRMAN. You would be manufacturing phosphates?

Doctor GLAESER. Yes.

The CHAIRMAN. And your potash would result as a by-product?

Doctor GLAESER. Yes. Either potash with acid phosphate as the by-product, or acid phosphate with potash as the by-product.

The CHAIRMAN. The expense, now, as I understand it, of making the phosphate would be considerably less than what it costs under present conditions to get phosphate?

Doctor GLAESER. Yes.

The CHAIRMAN. The potash entering into your fertilizer would not cost anything if you charged the cost all off to the acid phosphate?

Doctor GLAESER. Yes, sir.

The CHAIRMAN. Have you computed what it would cost in the nitrate plant down there to get the nitrogen to be able to produce complete fertilizer?

Doctor GLAESER. I have not, because I do not know the operating cost for producing that.

The CHAIRMAN. How much power would it take, if we put in 10 units, 500 tons daily capacity?

Doctor GLAESER. I don't know, but it can be easily figured out by a mechanical engineer, if he knows that the heat treatment takes one hour at 1,500 degrees Fahrenheit.

The CHAIRMAN. Your cost would depend on what your power costs, would it not, to produce the heat?

Doctor GLAESER. Oh, yes.

The CHAIRMAN. How can you give us those figures until you know what your power is going to cost?

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Doctor GLAESER. We had this figured out by the Fuller Engineering Co.
The CHAIRMAN. Well, do you know what their power costs them?
Doctor GLAESER. Yes.
The CHAIRMAN. How much?
Doctor GLAESER. You can get that statement from Mr. Gaffney. He made the calculations under the supervision of Colonel Fuller a few days ago.
The CHAIRMAN. Yes, but I am trying to get some information about your figures as to cost of complete fertilizer.
Doctor GLAESER. My cost figures are based on the Fuller Engineering Co.'s operating cost figures.
The CHAIRMAN. I think we ought to know what their cost is. Is it based on water power production or steam production?
Doctor GLAESER. It was not based on electricity. It was based on coal.
The CHAIRMAN. It was not based on water power at all?
Doctor GLAESER. No; it was based on coal. It was something like $3.54 per ton.
Senator KEYES. When were those estimates made?
Doctor GLAESER. In 1918.
The CHAIRMAN. If you could do that with coal costing $3.54 per ton——
Doctor GLAESER (interposing). No, not $3.54 per ton of coal, but $3.54 per ton of feldspar.
The CHAIRMAN. What did your coal cost you in those calculations?
Doctor GLAESER. I have not got those figures with me. I am sorry.
The CHAIRMAN. We get back to the fact that we are going to use electric heat, now.
Doctor GLAESER. Yes.
The CHAIRMAN. To do that, we have to have electricity. Are those figures based on the cost of making electricity from coal?
Doctor GLAESER. No; we used coal in our experiments. We used the coal to produce heat.
The CHAIRMAN. And made electricity?
Doctor GLEASER. No; we did not make any electricity. We used coal as the source of the heat.
The CHAIRMAN. I understood you to say that when you got your plant in operation you would use electric heat.
Doctor GLAESER. Exactly. At Muscle Shoals, of course, the energy is much cheaper than if we produced it in a furnace; you know, by means of coal.
The CHAIRMAN. Well, now, then you ought to be able to give us, when you make those calculations, the price of coal.
Doctor GLAESER. I have not got that here. I am sorry. You can easily get that. The Fuller Engineering Co. made the estimate for us.
The CHAIRMAN. As to whether it is cheaper or not depends on what the coal costs to get your heat more than any other one thing.
Doctor GLAESER. I am not prepared to give you the cost of coal. I do not know what it was.
The CHAIRMAN. You have drawn certain conclusions there. You get your potash for nothing, your phosphate at a less price than we pay now. In order to figure that out one of the principal items is the cost of coal, and I want to know what you figure that.
Doctor GLAESER. I can give you the combined operating cost per ton of feldspar, which is $3.54, which includes all the heat treatment; but what coal was figured at I don't know, but you can easily get that figure by asking Doctor Worden, of Milburn, N. J., or Mr. Gaffney, of the Fuller Engineering Co., to come here. In fact, they will let you see all the cost calculations that they made for us three or four years ago.
The CHAIRMAN. Are you a chemist?
Doctor GLAESER. Yes.
The CHAIRMAN. How long have you been a chemist?
Doctor GLAESER. About 20 years.
The CHAIRMAN. What is your nationality?
Doctor GLAESER. I was a German. I am now an American.
The CHAIRMAN. When did you come to this country?
Doctor GLAESER. In 1903.
The CHAIRMAN. Did you study chemistry in Germany?
Doctor GLAESER. Yes, sir; at Breslau and also in this country.
The CHAIRMAN. I have been very much interested in what you have said, and I am interested in getting what the power costs.

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Major, am I right in assuming in order to get the basis of the calculation we would need to know what the coal costs?

Major BURNS. Yes, sir. We do not know how it would compare in this scheme. It is not shown by any comparison with electricity.

The CHAIRMAN. Instead of heating with coal, as you did in your experiments down there, you would use electricity without coal, and it is important to know whether that is cheaper or more expensive than to produce the heat from coal. I assume under ordinary circumstances it would be, because water power down there is cheaper than coal. Everyone will admit that.

Senator KEYES. I suggest, Mr. Chairman, that the witness, if he cares to, would furnish the figures that that engineering company gave him. If they have made those figures, he could get them easily and put them in the record.

The CHAIRMAN. Would you do that, Doctor?

Doctor GLAESER. Yes, certainly. I can mail them to you.

The CHAIRMAN. That is what I mean.

Doctor GLAESER. I will get you the whole cost.

The CHAIRMAN. We are particularly anxious to know in the figuring there—to know what the coal cost.

Doctor GLAESER. From my recollection it was either $3 or $4 a ton; something like that. But I can not swear to that.

The CHAIRMAN. We can get electricity at Muscle Shoals, assuming full development there, at about how much per ton of coal?

Major BURNS. If we were making power, the chances are it would be about 5 mills per kilowatt hour, but if you are making electricity it can be sold at a lesser price than if he made electricity by coal. If he is going to burn coal to make electricity to produce the heat at Muscle Shoals he would be able to use electric heat and get it cheaper than he would be able to get coal heat. But that is a little different phase. You do not get as much efficiency out of electricity when you use it as heat as you do out of coal.

The CHAIRMAN. You do not get as much efficiency out of electricity if you convert it to heat as you do if you convert it to power?

Major BURNS. No. Electric heat, as a matter of fact, is pretty expensive.

Doctor GLAESER. I know; but I have been told that there is a lot of electric power available at Muscle Shoals, and I assume that the electric power is produced at a cost much lower than if it were made here.

The CHAIRMAN. Have you made any figure in your mind as to what the electricity down there would be worth?

Doctor GLAESER. No.

The CHAIRMAN. In your statement that you have outlined to us how much power do you use as distinguished now from heat? Is power an item of any considerable importance in your process?

Doctor GLAESER. There isn't much power required. In a 500-ton plant we use about twenty-five 5-horsepower motors.

The CHAIRMAN. That would be 125 horsepower?

Doctor GLAESER. Yes.

The CHAIRMAN. That is quite an item.

Doctor GLAESER. You see, we have to operate those kilns.

The CHAIRMAN. In your figures what kind of power did you use—coal?

Doctor GLAESER. No; we used electric power.

The CHAIRMAN. Electricity by the hydroelectric, or produced by coal?

Doctor GLAESER. No; we bought it.

The CHAIRMAN. Oh, yes. Do you know what you figured it at—what it cost you?

Doctor GLAESER. It is in that estimates. I don't know. It is 2 cents or 3 cents.

The CHAIRMAN. Per kilowatt hour?

Doctor GLAESER. Yes.

The CHAIRMAN. It would make quite a difference whether it was 2 cents or 3 cents.

Doctor GLAESER. I know. But there is such a great margin of profit, you know, that even if the electric power would cost as much, or, rather, if the power necessary for this process here to be used at Muscle Shoals would cost as much as the power cost here in the East, you know, the margin of profit would still be large.

The CHAIRMAN. Your scheme, Doctor, I think is of great importance and worthy of consideration, but it does not bear directly on the queston of our velopment at Muscle Shoals, excepting as we provide there to lease it or erate it ourselves for the manufacture of a complete fertilizer.

Doctor GLAESER. Exactly.

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The CHAIRMAN. It would fit in with Muscle Shoals, perhaps, very nicely.

Doctor GLAESER. That is the reason I considered the question of appearing here, because it seems to be interesting.

The CHAIRMAN. It is very interesting, and we are all interested, of course, in getting a fertilizer as cheaply as possible. In fact we have to get some plan to cheapen it or else it is very doubtful whether we can make it.

Doctor GLAESER. You see the main feature of this process here is the exclusion of oxygen in the heat treatment. They did not realize that water vapor causes a great disturbance after the potassium chloride has once been liberated. They did not realize that. It has to be done in a muffle furnace, where the water is kept out, and the hot stuff discharged into a box that is also kept free from water vapor. Air and water steam acting upon liberated potassium chloride in silicate mixtures at elevated temperatures will change this potash back to the insoluble state. By keeping it free from contact with water steam the liberated potash remains soluble.

The CHAIRMAN. If Muscle Shoals is developed—and I presume it will be, whether it is done through a lease or whether the Government does it itself—whoever had charge of it would be very much interested in your outline, and, of course, would give it very careful consideration.

I think it would be well right here to explain, for the record, what a unit is.

Doctor GLAESER. A unit in the fertilizer trade is 20 pounds per ton. One per cent per ton is a unit. One per cent of 2,000 pounds is 20 pounds. A unit is 1 per cent per ton.

The CHAIRMAN. Can you make that any plainer, Major Burns?

Major BURNS. A unit is 20 pounds. That is what it is. It comes about by using 1 per cent per ton. It is only used in the fertilizer trade.

Doctor GLAESER. Phosphoric acid, nitrogen and potash, valuations in fertilizers are based on units. Potash is always expressed in terms of K_2O. K stands for potassium and O for Oxygen. All potash formulas are based on the unit as 1 per cent of K_2O per ton.

The CHAIRMAN. Now, Doctor, have you anything else you want to tell us?

Doctor GLAESER. No, sir; nothing else, except that I urge you to give us consideration. I do not care who takes it up, you know. Somebody will take it up.

The CHAIRMAN. Yes; I suppose so. I do not believe the committee will give direct consideration, because that will come after the plant is developed and we try to utilize it.

Doctor GLAESER. Yes.

The CHAIRMAN. But it is exceedingly interesting. The manner in which you have treated it, I think, is very valuable. It will not be so valuable to us, but it will be very valuable to whoever operates that plant.

Senator KEYES. Looking to the production, which we are all desirous of seeing brought about, of a complete fertilizer.

The CHAIRMAN. Yes, and the testimony we have had about the fertilizer proposition is rather discouraging. Some take a very rosy view about it, although we might just as well face the absolute truth. To my mind I am, rather against my own will, led to the conclusion that unless there is some improvement developed by scientific men the fertilizer proposition does not offer very great inducement to us. What is your conclusion, Major Burns?

Major BURNS. My own view is that the possibility of Muscle Shoals being developed as a fertilizer proposition is not very great.

The CHAIRMAN. I have formed that conclusion from the testimony. In fact my prejudices all go the other way. I am anxious to get fertilizer, no matter who does it, at cheaper prices, as a peace proposition. That is all there is in this for the country. It looked to me for a good while the experts and scientific men said they were going to improve it, I have been brought to a realization that it is absolutely necessary for it to be improved, and I think we can well afford to spend a good deal of money in doing it. It is absolutely necessary to improve it in order to make a completed fertilizer and cheapen the product to the farmer.

Senator KEYES. The prospect of reducing it one-half is rather remote.

The CHAIRMAN. Very remote. It is just a hope, that is all. There is not anything in the testimony to base that opinion on.

If that is all, we are very much obliged to you, Doctor.

Doctor GLAESER. I am obliged to you gentlemen.

(Whereupon at 11.30 o'clock a. m. the committee adjourned subject to call of the chairman.)

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MUSCLE SHOALS.

MONDAY, JUNE 12, 1922.

UNITED STATES SENATE,
COMMITTEE ON AGRICULTURE AND FORESTRY,
Washington, D. C.

The committee met, pursuant to call, at 10.30 o'clock a. m., in room 224, Senate Office Building, Senator George W. Norris presiding.

Present: Senators Norris (chairman), Capper, Keyes, Ladd, McKinley, Ransdell, Kendrick, Harrison, and Heflin.

The CHAIRMAN. The committee will come to order.

STATEMENT OF MR. TIMOTHY D. GLEESON.

The CHAIRMAN. I wish you would give your name, address, and occupation to the reporter.

Mr. GLEESON. Timothy D. Gleeson, 417 West Forty-seventh Street, New York City. Occupation, contractor and invention coordinator.

The CHAIRMAN. How long have you been in that business, Mr. Gleeson?

Mr. GLEESON. The invention business?

The CHAIRMAN. Yes; and the contracting business.

Mr. GLEESON. Oh, since I left school; 8 years old.

The CHAIRMAN. Have you made an examination of the Muscle Shoals project?

Mr. GLEESON. No, sir.

The CHAIRMAN. What study have you given to the subject?

Mr. GLEESON. I have not made a study. The interest that we take in Muscle Shoals is in its connection to the national preparedness of this country.

The CHAIRMAN. Now, when you say "we" to whom do you refer?

Mr. GLEESON. The Association of Practical Inventors of America.

The CHAIRMAN. Are you a member of that association?

Mr. GLEESON. Yes, sir.

The CHAIRMAN. And an officer of it?

Mr. GLEESON. President and chief examiner.

Senator MCKINLEY. Practical inventors?

Mr. GLEESON. Of America; yes, sir.

The CHAIRMAN. What is the object of that association? Tell us something about it, and of whom it is composed.

Mr. GLEESON. This organization was organized for the purpose of aiding America in the late war. The first work done by this organiaztion was sending plans to the Navy Department for the construction of dry docks of a larger type, a copy of which was published in the New York World, Sunday, April 15, or a description of it. In this we offered the Government to supply it with men capable of supervising the construction of a drydock in 90 days by an entirely new principle. In this work we agreed to do or perform this work aided only by enlisted men, with the implements and equipment of which the War Department had at the location which would be selected for the work.

In August, of 1918, I appeared before Rear Admiral Strothersmith. I was then supervisor of inspection and the specifications division under Major Crosby. We submitted to Rear Admiral Strothersmith this plan which I have here. It is a plan for the protection of cargo-carrying boats from the torpedoes shot from submarines.

The CHAIRMAN. How large a membership have you in that organization?

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Mr. GLEESON. Our membership varies. We sometimes have a thousand. Our men travel all over the world. We have got men on water, men on the sea.

While I was speaking to Rear Admiral Strothersmith on behalf of the organization, we submitted a plan which had for its main object the prevention of land communications for submarines, which I believe was acceptable and used by the admiral. Many times during the war I was compelled to appeal to Rear Admiral Bradley A. Fiske, due to the inattention which the plans and communications which we sent to the Navy Department received at that time. Rear Admiral Bradley Fiske admitted that he was unable to render us any aid whatever. He told us that his recommendation would have a deterrent effect on the acceptance. This report that I have submitted a copy of to this committee calls attention to the inadvisability of selecting as inspectors of ammunition men taken from the civil service list, owing to their inexperience, lack of instruction, and, in many cases, lack of physical ability to withstand the odors and poisons which are met with.

The CHAIRMAN. I was anxious only to have you state in a general way, so the committee would get an idea what your business has been and what you have done. I want to get down to what you think of Muscle Shoals.

Mr. GLEESON. I am a graduate of the United States ordnance shell loading school, at Morgan, N. J.; one of five members of that organization that passed with 107.

The CHAIRMAN. What study have you or has your organization made of any proposition connected with the matters that we have here before us for hearing, in regard to Muscle Shoals?

Mr. GLEESON. An inventor or scientist is like a doctor or lawyer. They are on different cases every day. There are matters brought to their attention that affect conditions at a distance. From the reports given me by my men. I am thoroughly convinced that should the stock and the control of Muscle Shoals fall into the hands of unfriendly elements, due to the effect of the cheapness of the development of power in Muscle Shoals, they can select a hundred, one dozen, or ten thousand or more articles which require power in their manufacture, which are being manufactured in American factories, from which the American manufacturer makes a profit and American workmen make living wages, and they can manufacture them so cheap, if they got control of Muscle Shoals, that they can flood our markets and destroy our markets. They can then, with the surplus left over, send and fill our export orders. If they ship that in foreign bottoms they will drive our fleet from the sea, drive our cargo-carrying fleet from the sea. I would like to impress upon you gentlemen the fact that there should be control of this Muscle Shoals, which is of more value to America than the gold of Klondike and of as much importance as the Panama Canal—should this control fall into the hands of men who should so desire, they can bankrupt America.

Senator CAPPER. May I ask what plan you suggest for the control of Muscle Shoals?

Mr. GLEESON. That this country keep that Muscle Shoals for 10 years, construct and maintain a bureau as described in the report which I submitted to your committee, which has for its object the training, instruction, experimenting, and opportunity for experimenting and research work in explosive chemistry and in the mechanism and machinery used for war purposes; to use as the instructors Army and Navy officers and enlisted men of good records, who have had experience in the battle fields of Europe and in the training camps of America; and America would thereby gain in preparedness far more than she would gain from the offer of any particular bidders for that plant. America lost more through the inefficiency of 50 of its one-dollar-a-year men during the late war than the amount of the entire bidders in the cost of completion of those dams and the operation of that plant for the next 50 years.

When we entered the war our Ordnance Department was not prepared or had not received sufficient instruction to manufacture munitions. We were compelled to take men from the du Pont people, the Bethlehem Steel Co., the General Chemical Co., and other corporations employed in the manufacture of material for war purposes. The first men we took we assigned to the work of preparing the instruction and for operation of factories. When those factories were completed and ready for operation these men found that the men of the Ordnance Department had not received sufficient instruction to carry out their orders, and they were then compelled to take men from their own corporations, or from other corporations engaged in the same line of manufacture, and place 'n charge of the departments. While these men did good work throughout r, when the armistice was signed they went back to their own corpora-

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tions, and the Ordnance Department to-day is not advanced to the point which it should be. It lacks standardization. It has not gained in efficiency through this war lesson, as it should have done, and it is not due to the officials of the Ordnance Department. The officials of the Ordnance Department are competent, capable men, men whom I have seen, like Crosby Field, work 12, 14 hours a day, 7 days a week; and other men the same. That is due to the interference of welfare workers, advertising men, contractors' agents, and politicians, and the work of manufacturers of munitions.

I have given this committee two letters. One describes the explosion in Morgan, N. J., and the other is some statements I have brought to the attention of Rear Admiral Strothersmith at the time when I appeared before him the second time—I appeared before him twice—as to the condition of New York City.

New York City is to-day, and was throughout the war, the most defenseless first-class city in the world, due to the fact that its water system, with its powerful pressure—47 pounds per foot, or from 27 to 47 pounds—runs so close to the sewer that at any time, without a violation of a corporation ordinance, a manhole could be lifted, the sewer emptied through the manhole, and an amount of explosives deposited close to the water main that would not only destroy New York City but would affect the efficiency of the Brooklyn Navy Yard, due to the fact that the East River water in that section of Brooklyn, N. Y., is all oil, and if they took water for their boilers from the river their boilers would foam.

Senator HEFLIN. Do you recall the report made by an investigating committee in the House when it urged that this whole project be abandoned down there—that it was nothing but a lot of junk?

Mr. GLEESON. No, Senator; I do not.

Senator HEFLIN. A year ago or more. When was your attention first drawn to this Muscle Shoals project?

Mr. GLEESON. In 1900 I was a partner of Bill Hoy, the diver that got drowned in Jersey. He had been down with the United States engineers at Colombia, and worked as a diver down there, and had been interested in this Muscle Shoals. I had as a roommate at that time for several years a Major Camp, of Mississippi, who had made a study of Muscle Shoals, of the possibilities, of its power, and of its general condition.

Senator HEFLIN. Well, when did you have your attention drawn to it recently? You say you do not recall this House committee's report when it recommended that it should be abandoned and it was abandoned. You don't know anything about that report, do you?

Mr. GLEESON. I have never seen it.

Senator HEFLIN. When were you invited to look into it and express your opinion on it? Since Mr. Ford made his offer or before?

Mr. GLEESON. Since.

Senator HEFLIN. Since he made his offer? You are opposed to accepting the Ford offer?

Mr. GLEESON. Well, I believe that Muscle Shoals is one of the main assets of America, and I believe that, due to the unsettled condition of Europe at the present time, where through the companionship of misfortune a combination needs only the leadership to attain the resources and the man power of Russia, the science of Germany, and the energy of Japan, due to that fact, I believe—and men that I have spoken to believe—that this country should retain Muscle Shoals and operate it through Government ownership and operation or under Government direction and cooperation, which would allow the use or development of part of the plant which was supposed to be next to any locality.

Senator HEFLIN. So you would have us just take charge of it and shut out all these bids made by private individuals for a period of 10 years?

Mr. GLEESON. Yes. I believe that the experience gained by our Army officers and by our Navy officers and by our men, when given to this Government and in a condition in which the Muscle Shoals will allow it be presented, will make Muscle Shoals so valuable that 10 years from now this Government would not part with it for any amount of money.

Senator HEFLIN. Before Mr. Ford made his offer it was just lying there. Nobody was figuring on it and nobody made an offer for it. But as soon as he has made his offer, and it looked like the Government was going to look with favor upon it——

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Mr. GLEESON. It is hard to make this Government move. I made the statement here that New York City that, from the Nation's standpoint, is the backbone of America, it was the most defenseless city in the world. The loss of New York City would be a calamity throughout the world. Whom did that interest? It is hard to interest America, and for that reason I believe that Senator Norris has found a solution in this bill of his. Enact this bill and put men in a position where they can act, men who can understand you when you come back to them——

Senator HEFLIN. You think, then——

Mr. GLEESON. I think Senator Norris's plan is the most effective plan that has been offered to this Government since the Muscle Shoals was taken under consideration.

Do you know the record of the Cyanide Co. of America that built that plant, as compared with its supply of explosives to this Government? Up to the time of the signing of the armistice the Cyanide Co. of America manufactured 500 tons of ammonium nitrate under six specifications. The calculations were, from the information I have received as to the amount of explosives used in action as compared with those manufactured in relation to high explosive shells, that 1 out of every 1,200 high explosives shells that was manufactured found a place in action. By using that as a basis of calculation and assuming that all the ammonium nitrate supplied by the Cyanide Co. of America to the Ordnance Department, in allowing them to the day of the signing of the armistice—it would have to be sent in a month before that to get action, but allowing them that latitude a 75-millimeter shell contains 2 pounds of explosives, 1 pound of T. N. T., and 1 pound of ammonium nitrate, and with all this great preparation, the aggregation of bacteriologists, lacking practical experience which is now possessed by the Army officers, this plant turned over to the Ordnance Department a sufficient amount of explosives to load 200 shells. A 75-millimeter gun shoots 30 a minute. With all this big preparation, with all this big organization, that company supplied the Ordnance Department with a sufficient amount of explosives to supply a 75-millimeter gun for 7½ minutes.

The CHAIRMAN. You mean that was all the supply of explosives that they had?

Mr. GLEESON. That is all the supply.

The CHAIRMAN. Well, that was before the erection of this plant?

Mr. GLEESON. No; that is giving them up to the day of the armistice.

Senator HEFLIN. In other words, you mean that if they had 100 shells only about 20 of them would shoot?

Mr. GLEESON. No. How many shells went up in the Morgan explosion? How many shells were lost on boats that went down or through the battle front being changed, or misdirected? The average is supposed to be, and the accepted average, that 1 out of ever 1,200 shells manufactured and loaded in an ammunition plant is used in action.

The CHAIRMAN. You mean there is one out of every 1,200 that——

Mr. GLEESON. That finds its way to actual action. I mention that to impress you with the vast amount of explosives necessary should we go into hostilities. You must remember, Senator, that in the last war we had the supervision of two countries.

Senator HEFLIN. That would not happen, would it, ordinarily? That was a new experiment with us with these high explosives?

Mr. GLEESON. Nothing would happen. I went to Morgan as a student in the shell-loading school, and they told me it could not happen. That is the history of explosion—that it can not happen. There never was an explosion caused by an explosive. It has been caused by the use of an explosive.

Senator HEFLIN. You mean somebody caused it to explode?

Mr. GLEESON. I mean by any explosion. Take dynamite. There never was an explosion caused by the use of dynamite. It has been caused by the misuse of dynamite and by the abuse of dynamite.

Senator HEFLIN. Do you mean that somebody would do it purposely or accidentally, or what?

Mr. GLEESON. Well, explosives—the ordnance officials will tell you that explosives should be given over to men physically fit. A nervous man—there is not any difference between a nervous man in an ammunition plant and a man with incendiary intent.

Senator HEFLIN. You mean if he drops it, then the thing happens?

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Mr. GLEESON. If one man loses his heart, you lose the plant. Have you read the report on that Morgan explosion, Senator?

Senator HEFLIN. No; I have not.

Mr. GLEESON. It is interesting. It will give you a good line on civil service. I said right here that the selection of men for the work of handling explosives, of men taken from civil service, is a national menace.

Senator HEFLIN. You think they ought to be selected from men who have had experience?

Mr. GLEESON. The men should be tried. If you had a roof to fix on your house to-day you would get a roofer, or if you had some plumbing to do you would get a plumber. You would not go out there and put a piece of paper in a man's hand and say, "Write down 'I am a plumber,'" and let him come in and do your work for you. Still, the Government will do that. They should be practical men that understand their business, physically fit for that business, even though they can not pass an examination. They should be physically adapted by nature. Take Grant. He could not handle a bank roll, but he could handle an army. Lincoln could not run a grocery store, but when he had the Government behind him he could run a government. There were naturally fit and naturally adapted to the work, and you can't beat nature.

Senator HEFLIN. Now, getting back to Muscle Shoals, this great water power down there is serving no good purpose. Mr. Ford proposes to utilize it and to turn it over to the Government in time of war to make nitrate and other war materials. Why not let him use it during this 10 years that you are talking about, and if a war should come the Government will have the use of it.

Mr. GLEESON. Well, why does not the Government take it? The Government has got a better record for accomplishment than Ford has. In America to-day there is ten times the amount of scientific and mechanical ingenuity as there is in Germany and France and all these big laboratories combined, and all America has got to do is to prepare an avenue such as described in Senator Norris's bill, adopt the method which was adopted by Napoleon, and have the knowledge broadcasted that you want the best, and every position in these departments or this organization is open to ability, and there is not anything that Germany has to-day or France has—and I will include the German dyes—that I can not duplicate in six months with these resources. Why should the Government not do it? The farmer wants plows. Why doesn't Ford expand and make plows for the farmer? The farmer wants ditching machines. Why doesn't he make ditching machines? Why doesn't he make steam shovels? He doesn't understand how to do it.

Senator HEFLIN. He may do that down there. He is going to make a lot of things if he gets this water power.

Mr. GLEESON. I will tell you what he did do, Senator. The housing situation in New York City, the shortage of homes for the poor people of New York City is affecting the birth rate of the country. It is affecting the health and morality of this country. It will be felt in future generations. We have got in New York City 300,000 flivvers housed in garages and places formerly occupied by the poor tenement families, and they were ripped down to build those garages, and 1 out of every 10 of those 300,000 flivvers occupies a place that was formerly the home of a contented family and a workman, and if Mr. Ford was a philanthropist and wanted to help the people, why doesn't he take his big resources that he has got and build homes to house these poor people that he has menaced through the scourge of flivvers making them homeless?

Senator HEFLIN. On the other hand, he has sold those machines through the country and he has enabled thousands and hundreds of thousands of farmers to own these machines because they are cheap, and he has thereby increased their comfort and convenience. But you would withhold that from them in order to take care of New York City. Is that the idea?

Mr. GLEESON. I would withhold any comfort in order to save life—life and human health.

Senator HEFLIN. You said a while ago that New York is the most important point in the United States.

Mr. GLEESON. From the Nation's standpoint. It is the backbone of America.

Senator HEFLIN. A good many people seem to have that theory down there.

Mr. GLEESON. I would give five years of my life, Senator, for your eloquence, to be able to explain this as I would like to in order to bring about the Government ownership and control.

Senator HEFLIN. You have explained very glibly, I think.

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Mr. GLEESON. The Senator's bill wants to create a condition similar to that created by Germany for years previous to the war. It was to encourage and enable the scientists and inventors to bring out improvement and development, which then became national property. At the present time let us consider Germany. Its army is destroyed. Its navy is scrapped. It is shackled down by taxation and reparations payments. Its currency is not much better than waste paper. And still, with all that, due to the loyalty and ingenuity of its inventors and its scientists, aided by the fact that the Government claims the ownership and does own and control scientific knowledge, it will be only a few years before, with the aid of this scientific knowledge for capital when everything else has failed, Germany will be back as a first-class nation, and in the face of that, what offer does Ford or any other bidder who is now bidding on Muscle Shoals offer to America that would compare with that prospect or that opportunity?

From the late war we have got men gassed, subjected to conditions of bad breathing, exposure, and they are cramped up in cities. Why not bring these men down and let them breathe broad ozone on the broad prairies down there and furnish them work and employment, and let the Government be the gainer by the experience and by the efficiency that they will develop, which will give this country the highest state of preparedness and protection, which will mean security and industrial peace for years to come?

Senator HEFLIN. How many men would it give employment to down there, of these ex-soldiers you are speaking about?

Mr. GLEESON. I should say, if I was running the job, I would give everyone that wanted to work a job. I would find a place for him.

Senator HEFLIN. Will the project down there admit of that?

Mr. GLEESON. That project down there, from a Government standpoint, when the Government goes in for the manufacture of munitions, when they go in for the manufacture of fertilizer, when they go into experiment, Senator, you must remember that there are many improvements. The improvements made in our power machinery are such that it is reasonable to assume that within the next 10 years the improvement and advancement in water-power machinery will equal that of the automobile and the airplane in the past 10 years.

Senator HEFLIN. Well, how many men do you think, now, the Government could furnish work to at Muscle Shoals?

Mr. Ford has proposed to give several thousand men employment, and it has been said here by witnesses who oppose his bid that it would not require but a few men to make fertilizers or munitions.

Mr. GLEESON. I would like, with your permission, Senator, to finish this. I believe it pretty important at this point.

Senator HEFLIN. All right.

Mr. GLEESON. Due to the fact of the cheapness of water power, the improvement has gone so far that even to-day there are men in New York City who, by attaching the water-power machinery to Blackwell Island, which was formerly used for convicts, can supply light, heat, and power to New York City, but they won't be allowed to do it, because they can not lay pipes. But the point I want to make is the cheapness of electric light and electricity for heating purposes and for all the purposes for which illuminating coal gas has been formerly used will cause the abandonment and abolition of the illuminating gas plants; and it is from the illuminating gas plants that we get the supply of T. N. T., which, in turn, is nitrated—we get our supply of toluol, which is again nitrated and becomes T. N. T. Should the illuminating gas plants shut down, America will be confronted with the necessity of discovering a substitute for T. N. T. for loading its high explosive shells. If you turn over this plant to Ford or to any of the other bidders—not mentioning Ford in particular, but any bidder—and the change in power is made in these illuminating gas plants—and they are owned to-day by the same company, and they will install economic measures at any time—America will be confronted with the necessity of discovering a substitute for T. N. T., and she will have to build nitrate plants, and she will never get as desirable a location as is offered by Muscle Shoals.

Senator HEFLIN. But Ford offers to turn this one over to the Government if she needs it.

Mr. GLEESON. You heard what Washington said, Senator? "In time of peace prepare for war."

The CHAIRMAN. Your theory is that if we turned it over to Ford or anybody else and we get into war and they turn it back to us we won't be ready to handle it?

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Mr. GLEESON. We will have the same condition that confronted us with the airplane situation, where this Government spent a billion dollars in an attempt to kill two birds with one stone, manufacture battle planes and improve the Liberty motor. The Government spent a billion dollars, and the sum total of the knowledge that we gained by building battle planes and improving the Liberty motor was the fact that we could have made castor oil out of castor beans, and we could have found that out from a black savage off of a boat. You should not wait until the last minute. In the late war there was time, but the next time, an hour, a day, or a week, will mean extinction.

I don't want to change your impression of Ford. Ford is a good man. The name of Ford carries with it an assurance of fair dealing. But this job is too big for Ford. There is no organization capable of undertaking Muscle Shoals with the exception of the United States Government itself.

The CHAIRMAN. Let me ask you in your analysis of the Ford bid and anybody else's bid, have you found any of them that have even agreed to keep up the analysis and the experimentation that is provided for in the bill that you speak of?

Mr. GLEESON. Well, Senator, I have not done that, but of course I do not place much faith in a contracted agreement. You take John A. Stevens. John A. Stevens is a great engineer. He was General Goethals predecessor in the Panama Canal. When John A. Stevens resigned as constructor general of the Panama Canal it was believed to be a national calamity. He came on to New York and started half a dozen contracts and failed in every one of them. One that he failed on was a branch of the subway. It was built by Bill Devery, a former police officer, and Frank Farrell, a race track bookmaker, who never knew anything about contracts. A contractor stands well while he is making a profit. Any official of the United States Government that has had to do with contractors will tell you that if a lawyer disputes the amount and wants to refuse payment of the contract he will find fault with the plans. I have had experience with contractors since I was 8 years old.

The CHAIRMAN. Have you examined Mr. Ford's proposition in detail?

Mr. GLEESON. I merely read over that Rowland Thomas—I think his name is—of the World.

The CHAIRMAN. I want to ask you, Are you familiar with that part of the contract in which it is provided that the Government of the United States shall guarantee during this entire 100 years to repair both of those dams, and that the only compensation for repairing one of them will be to the extent of $20,000 in dam No. 3 and $35,000 in dam No. 2, that they shall receive from Mr. Ford? As a contractor and inventor, now, do you think that in a hundred years, taking it over a term of a hundred years, there is liable to occur many years in which a much larger amount than that will have to be paid to keep the dams in repair, and that it will amount to several million dollars, all of which the Government, with the exception of the sums I have named under Ford's contract, has got to pay without any return, without any recompense, and without any interest on its money?

Mr. GLEESON. We have a precedent at Johnstown, Pa. A well-built dam gave way.

The CHAIRMAN. Yes.

Mr. GLEESON. I believe in reading over Ford's bid it was a bid offered by a man who thought he had no competition; that the Government was in a position that they would have to give it to him; that it was a matter of courtesy as to the amount. Now, another point that I wish to make. In this report here, of which the committee has a copy, this calls for the organization of a national construction, training, experimenting, and instruction bureau for explosive materials, tests, and supervisors, and it goes on to say—and it has not been contradicted as yet that this bureau would mean a lot in the way of preparedness. Had England and France maintained and developed a national institution such as described above their military preparation would have been advanced to the extent that the German military officers would have realized that their advantage by superior preparedness would have been so slight that they would have delayed the opening of hostilities, no doubt, indefinitely. Now, I have given a copy of these two reports to Ford's chief engineer at 1720 Broadway not three weeks ago. I told him to contradict these statements, if he could, that are contained in these reports.

Now, what became of all these aspirations that Ford was supposed to maintain relative to peace for the world and peace amongst men and brotherly love when he rigged out this ship? Was this peace ship for advertising purposes?

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Senator HEFLIN. I don't know. Do you think that is pertinent to this inquiry as to whether he should have Muscle Shoals now?

Mr. GLEESON. I think it is very pertinent to the consideration of the offer, inasmuch as preparation means protection.

Senator HEFLIN. We know that he made a success in making automobiles and selling them so cheap that the common man could buy them. Now, he says that he will make fortilizers so cheap that the farmer can buy them at about half the price that he is paying to-day. If he can do that, he will bless and benefit millions of American farmers.

Mr. GLEESON. Senator, I read in the Engineering News, I believe it was, of March, 1918, where the Navy Department advertised for sale 3,000,000 pounds of ammonium nitrate. If ammonium nitrate was a fertilizer, why in the name of common sense did not some of these people buy it? This specification that ammonium nitrate is made out of is not a fertilizer.

Senator HEFLIN. Are you an expert on fertilizer ingredients?

Mr. GLEESON. We have tried it on plants. We have tried cultivation, and instead of cultivating it, it was destroyed.

Senator HEFLIN. Don't you think Ford can manufacture fertilizers at Muscle Shoals?

Mr. GLEESON. I think a great country like this country here, Ford should come to these men, come to the officials and representatives of the country and find the needs of the country in the preparation of his bid. Ford seems to be carried away with his own importance. It is a case of Ford, the "U. S. I."

Senator HEFLIN. The question I asked you was whether you believe he can manufacture fertilizers at Muscle Shoals?

Mr. GLEESON. No; I don't believe he can manufacture fertilizers.

Senator HEFLIN. The testimony before us is that Mr. Edison says that there are phosphate rock beds and also potash beds in that vicinity. He says it is the most desirable place in the world—I believe that was his statement—for making fertilizers, because the ingredients are there. Now, you don't agree with Mr. Edison about that?

Mr. GLEESON. Well, I never met with Mr. Edison, but I have had experience with Mr. Maxim. He is quite an expert along the same line. He recommended women inspectors for absolute protection of munitions plants. In Old Bridge, N. J., he installed half a dozen women inspectors. There was a rule against anyone running in the plant, but I caught a woman running and I asked her what was the matter, and she said, "I am scared to death." She says, "The lady that Maxim recommended for absolutely safeguarding," she says. "she smokes a little, and stepped on a couple of parlor matches that she dropped and refused to pick up."

So I have never met Mr. Edison. I have had a lot of experience in this explosive business, but I have never met Mr. Edison. I can't see anything that Mr. Edison has done in the Ordnance Department. I tried to get them to let me go into a conference that was attended by Mr. Edison and his chief engineer. Hutchison, who was supposed to be his secretary.

Senator HEFLIN. Is that Reece Hutchison?

Mr. GLEESON. Hutchison is his last name. The difference between the Government manufacture and the manufacture of private material is that in the Government manufacture of war materials there is a certain sacredness. The private manufacturer manufactures war material the same as a 5 and 10 cent store, on the bonus, and they don't care what the condition of the ammunition is so they can get rid of it.

The CHAIRMAN. Is there anything further you want to say?

Mr. GLEESON. Well, Senator, I want to thank you gentlemen for the leniency you have shown me and the latitude that you have given me, and I hope that your bill goes through.

The CHAIRMAN. Well, we are very much obliged to you.

ADDITIONAL STATEMENT OF MR. J. H. LEVERING, CIVIL ENGINEER, WASHINGTON, D. C.

The CHAIRMAN. I understand that when you testified before you had some information in regard to the maintenance of these dams that you forgot to put in, and which you desire to put into the record now.

Mr. LEVERING. Yes, sir.

The CHAIRMAN. I will ask you to go ahead and state it.

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Mr. LEVERING. I will state that a short time ago the Interior Department published a book on superpower problem by Mr. Murray and at least 25 or 30 other engineers, and they made a very accurate report on maintenance of dams taken from actual figures. On page 226 you will find their report, and on page 27 the engineers'.

The CHAIRMAN. Is that the so-called Murray report?

Mr. LEVERING. Yes.

The CHAIRMAN. Comparing cost of electricity in America with cost in Canada?

Mr. LEVERING. Yes.

The CHAIRMAN. Yes. I just wanted to identify it.

Mr. LEVERING. In which he states that the dam maintenance will run from 1 to 3 per cent of the actual cost, which would make these two dams run from a half million to one and a half million dollars per annum.

I want to state that I have checked up very carefully the actual expenditures on several Government dams, which I will hand you, and comparing them with the actual expenditures with the Muscle Shoals dams the annual maintenance charges will run more than Mr. Ford will pay the Government for interest and other items annually to the Government.

The CHAIRMAN. What dams were those?

Mr. LEVERING. I have taken the Roosevelt Dam at——

The CHAIRMAN. At Phoenix, Ariz.?

Mr. LEVERING. At Phoenix, which is supposed to be a well-constructed dam.

The CHAIRMAN. Yes; I think it is.

Mr. LEVERING. I took the Granite Reef Dam, built by the Government and maintained by the Government, and therefore we get the Government expenditures. I have taken the dam at Lagoona and the actual expenses as they appear in the reports of the Government; and I have also taken the dam at Keokuk, but I have not got that quite ready.

The CHAIRMAN. When you get these you will give them to the reporter?

Mr. LEVERING. Yes, sir. I want to say that when I made investigation both times at Muscle Shoals I was impressed with the amount of water issuing at the Tuscumbia Spring. I took the matter up with Mr. Fred Cranford, who is, I think, one of the most experienced contractors in America, and he was at Muscle Shoals in behalf of Secretary Baker during the construction, and he informed me that an examination of the Tuscumbia was first a chemical analysis of the contents of the water at the dam and at the spring—these checked. To make it certain that that river water was issuing from the spring, they took a bacterial count of the water at the dam and at the spring; and sunshine bacteria is different from the bacteria in subterranean channels; and they checked.

The CHAIRMAN. And he reached the opinion that the water emerging at the Tuscumbia Spring came from the Tennessee River?

Mr. LEVERING. Yes, sir.

The CHAIRMAN. But he was not able to tell whether it came from above or below the dam, was he?

Mr. LEVERING. It could not come from below the dam, because it would not have come out at Tuscumbia. Major Burns can tell you about that.

Major BURNS. That is a hard thing to tell, because you have to get the levels. I don't know how much higher the river is at Tuscumbia. It would be a little bit higher.

The CHAIRMAN. It would not necessarily follow that there is anything wrong with the foundation of the dam even if it were true. It would show that some water is getting away, that is all.

Major BURNS. Yes, sir.

The CHAIRMAN. And we do not know where it is leaving the river.

Major BURNS. You saw the spring?

The CHAIRMAN. Yes, sir.

Major BURNS. It is like a subterranean river emerging at that spring.

The CHAIRMAN. If it came from above the dam, within reasonable distance above the dam, and the dam were completed and the head increased, it would show down in the spring, would it not?

Mr. LEVERING. Yes. It has got to be water sealed or the maintenance charge will run more than it does at Hales Bar. I want to say that I heard Secretary Weeks testify that on a foundation somewhat similar to Muscle Shoals the estimates at Hales Bar were $3,000,000, for completion. The dam has now got about $11,000,000 in it, and with the same rate of maintenance of these dams it would run into several millions of dollars the Government

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would have to pay each year, or at least part of it it would have to pay each year out of the revenues of the Government over and above the receipts from the Ford contract.

The CHAIRMAN. As an engineer, now, I will ask you whether or not it is true that we could expect the repair and upkeep of the dam to increase after it had been in use for a great number of years. For instance, this lease to Mr. Ford, if it is made, will be for a hundred years. Would it be reasonable to expect that the upkeep of the dams, after they had been used for 40 or 50 or 60 years, would be greater than it is now when the dams are new?

Mr. LEVERING. Much greater. The oldest concrete dam we have, I believe, is about 40 years old. Several have been rebuilt since that time.

The CHAIRMAN. Where is that one 40 years old?

Mr. LEVERING. Somewhere in the East. I don't recall just where. The oldest one that I know is the Sweetwater Dam, in California. I am familiar with that. That was built probably 30 years ago, or 35 years ago, and it has been rebuilt three times, and that was built by Schuyler, and on good foundations. The foundation has never given much trouble.

The CHAIRMAN. The Ford proposition provides that the Government——

Mr. LEVERING. Can I make one more suggestion? I am afraid I will forget it.

The CHAIRMAN. All right.

Mr. LEVERING. Mr. Rickey, the chief engineer of the Aluminum Co. of America, went to Muscle Shoals long before the Ford offer was put in for the purpose of putting in an offer for the Aluminum Co. of America. They had had experience on the Tennessee River at Hales Bar. They furnished part of that money and had a very unsatisfactory experience with it, and they had considered the maintenance of that dam very carefully, and he advised his people that it was a dangerous proposition to bid on Muscle Shoals and open to a big risk.

The CHAIRMAN. Well, I don't believe it is open to any bigger risk than anything else. There is nothing sure. I think we have remarkably good evidence, based upon the best that can possibly be obtained, that all of the precautions have been taken in building the dam there that it is just as good as it is possible to build, but of course it may go out some day.

Mr. LEVERING. But this is true, Senator Norris, that if that dam is all right Mr. Ford should keep the $55,000 and do the maintenance. If it is an unfair price, it should not be put on the American people.

The CHAIRMAN. It is not $55,000 Mr. Ford agrees to pay. He agrees to pay to the Government $20,000 for the repair and upkeep of Dam No. 3, and $35,000 annually for the repair and upkeep of Dam No. 2. That includes the locks. Under his bid he keeps in repair the upper end of the dam. His bid specifically states that the Government must keep the dam in repair during the entire hundred years for that contribution. He does not use that to repair it, but the Government has to do it. The Government, under his bid, is bound to keep both of those dams properly repaired during the entire hundred years.

(Whereupon, at 12 o'clock noon, the committee adjourned to 10.30 o'clock to-morrow, Tuesday, June 13, 1922.)

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MUSCLE SHOALS.

TUESDAY, JUNE 13, 1922.

UNITED STATES SENATE,
COMMITTEE ON AGRICULTURE AND FORESTRY,
Washington, D. C.

The committee met, pursuant to adjournment, at 10.30 o'clock a. m., in Room 224, Senate Office Building, Senator George W. Norris presiding.

Present: Senators Norris (chairman), Capper, Keyes, Ladd, McKinley, Kendrick, and Heflin.

The CHAIRMAN. The committee will come to order.

STATEMENT OF MR. W. G. WALDO, CONSULTING ENGINEER, TENNESSEE RIVER IMPROVEMENT ASSOCIATION.

The CHAIRMAN. State your name and occupation.

Mr. WALDO. My name is W. G. Waldo. I am consulting engineer for the Tennessee River Improvement Association, with headquarters at Chattanooga, Tenn.

The CHAIRMAN. Tell us about this organization. What is it; just briefly?

Mr. WALDO. Mr. Chairman, the Tennessee River Improvement Association is one of those loose organizations that a man can join by contributing anything from a nickel to $500 who has at heart the interests of the Tennessee Valley. Those people who support it to the greatest extent, of course, are those who expect to gain by the improvement of the navigation of the Tennessee River, the development of power, the increase in the industries, the utilization of natural resources, and all of those things that go to make up a comprehensive program of development.

Among the duties that I have had in connection with the association has been that of looking after the financial end of it, and in that connection I have made the acquaintance of a good many business men up and down the Tennessee Valley, from the Republican section in east Tennessee, up around Knoxville, across to the Democratic sections in the Memphis territory at the other end of it.

The CHAIRMAN. You are in a fair way, then, to judge between the two, I suppose.

Mr. WALDO. I have had a good opportunity to obtain an idea of popular opinion on this subject, Senator, because I have come in contact with a good many people. I would like to present to you some facts in regard to Muscle Shoals. We have had a great many generalities and statements of one kind or another, but what I would like to offer is simply a statement of the concrete facts that we have available regarding this matter.

The association has been interested in Muscle Shoals for a good many years. I was surprised the other day to find a report of the Tennessee River Improvement Association, dated December 5, 1877, over here in the Congressional Library. My personal connection with the association dates from 1916. At the outset the idea of the association was simply to secure the improvement of the navigation of the Tennessee River. Later various other features came to be recognized as a necessary part of any program of permanent navigation improvement, so we adopted the broad plan of development involving principles which we hope may be introduced generally in the improvement of rivers in the United States. In connection with this program the association has been

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working with the Ford organization in bringing out an offer that would embody these principles. That is why we are for the Ford offer, because it does cover these principles in a broad way.

We had formerly been for Government operation of the Muscle Shoals project, and there are features of Government operation which we think are absolutely sound and certainly worthy of the support of any organization. At the same time, we realize that there are certain difficulties with it, which we believe are obviated by the Ford offer.

There have been nearly a hundred surveys of the Tennessee River in the last 90 years. Of those surveys there is only one that, in a detailed and in a comprehensive way, has covered the power situation and the other features in connection with the navigation. In all there are more than 10,000 investigations and surveys that have been made by the Engineer Department, and you can count on your fingers, practically, those surveys that have covered all the features that enter into such a proposition.

In speaking with General Taylor this morning he said that he did not think that there were more than a dozen surveys, all told, that considered so important an element as the power feature frequently is. We maintain that the improvement of a stream strictly for navigation purposes and for navigation purposes together with power development are two very different things. I would like to point out a few reasons why they are so decidedly different.

The Government has expended for navigation improvements of the Tennessee River up to June 30, 1921, $14,686,397; on the Ohio River for the same period they have expended $142,008,372. Although the Tennessee River is slightly the larger stream it has received about one-tenth, as you see, of the expenditures. But our idea is not simply to see how much money can be spent on the Tennessee River, but to see that we get the most for the money that is expended. In order to point out the accomplishments under present plans we prepared the chart that is here on this wall. It shows the efforts of the United States Engineers to secure a 3-foot channel by open-channel methods between Chattanooga and Knoxville. The red line shows the progress, starting at about 45 per cent completion in 1874, and in 1920, after a progression that seems to be mostly backward, arriving at 39 per cent completion, with no power development.

The solid black line shows the estimates of the cost of that improvement of this channel, varying from examination to examination, and the curve of expenditures, as you see, is increasing rapidly in the last four or five years: also the curve of estimates has gone up rapidly in recent years. It is evident from that chart that we are not going forward; that as fast as the channel is opened up a flood comes along, and for this reason or another the channel is partially filled and the work has to be done over again. We maintain that in such a case the principle of that is wrong; that if the navigation is to be valuable it must be a permanent navigation of sufficient depth and continuity to make a commercially navigable stream. In order to have permanent navigation you must have locks and dams, and if you have locks and dams then the question naturally arises, Why not develop the power that may be commercially available there?

Of course, it is an important feature that the flow of a navigable stream can not be stopped. You must allow it to run at some reasonable minimum rate. The United States Engineers would never give their approval to a project which contemplated the shutting off of the ordinary flow of a navigable stream. That has had a great deal to do with the development of power, because it makes it difficult to secure pondage or storage for power purposes under ordinary conditions, a difficulty that has been pointed out by a number of reports of the United States Engineers.

In general, a permanent channel is the only one that is of any consequence. This channel, you can see from the chart over here, is not a permanent channel. The United States Engineers have explained that the traffic on the Tennessee River did not justify the expenditures which would be necessary for a permanent improvement. We maintain that the Tennessee River never has had a chance.

If you had a boat line I would ask any of you gentlemen whether you would be willing to undertake to operate between Chattanooga and Knoxville when you knew that your channel, corresponding to the roadbed of a railroad, was going to be in that condition [indicating chart]; in other words, about 50 per cent of

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the time wholly unreliable, and the remaining 50 per cent of the time partially unreliable, so much so that you might have an accident at any time that would cost you more than your net earnings for an entire year. It is manifest to the people who attempt to use these streams that the actual traffic on a stream is no conclusive criterion for judgment as to how much that stream ought to have in the way of appropriations. We maintain that the idea of the United States engineers in setting up the actual traffic that exists on these partially developed streams as a basis for judging their navigable value is wrong. There is one example, and it is a striking one, of a fully developed stream, with a permanent channel, outside of the Great Lakes, and that is the Monongahela River. The Monongahela River transported in 1920 24,264,354 tons of freight, 85 per cent of which was coal, into the Pittsburgh district. It is the availability of the Monongahela River which has made possible the development of cheap pig iron manufacture in the Pittsburgh district, combined with the advantages that they get from the water transportation of ore on the Great Lakes. We consider the Monongahela to be an outstanding example of successful inland river navigation.

As to navigation on the Great Lakes, there is more traffic, as you well know, that passes Detroit in a given year than there is that floats on the Thames. Passing Detroit, in 1920, there were 80,410,082 tons with a valuation of about $1,135,000,000 in transit up or down the river.

Of course, we never expect to get any approach to such traffic on the Tennessee River, but we simply point to the Lakes as an example of cheap transportation on a waterway having a definite, dependable channel, where there is something to be hauled at a profit. If we can get the dependable channel we will not lack the cargo to be profitably hauled.

The cost of water transportation on the Great Lakes in 1920 was about 1⅛ mills per ton-mile. That is about 10 per cent of the cost of freight hauled by rail, and while we do not expect that the cost of transportation on the Tennessee River will be as low as 1⅛ mills per ton-mile, we do think that it offers a substantial means—a real means—of securing a cheap form of transportation for the Tennessee Valley.

Senator McKINLEY. Has the Mississippi been under navigation for a hundred years?

Mr. WALDO. No, sir. Not in the sense that we——

Senator McKINLEY. From St. Louis down, is it?

Mr. WALDO. Yes, sir. There is navigation on the Mississippi, Senator.

Senator McKINLEY. Was there not a great deal more navigation on the Mississippi 60 years ago than there is now?

Mr. WALDO. There was, and for very good reason, Senator.

Senator McKINLEY. Why?

Mr. WALDO. Sixty years ago there were no railroads paralleling the Mississippi, with low grades——

Senator McKINLEY. How are they going to compete with this cheap transportation?

Mr. WALDO. Because there are classes of freight that can go by water that are now being hauled by rail at a disadvantage, and investigations of the Interstate Commerce Commission will show that there are certain classes of freight that are hauled at a distinct disadvantage to a railroad company. Such classes of freight can go by water with advantage. For instance, if you will look behind you there, Senator, you will find a map that shows the marble deposits of the Tennessee Valley, and you will see that the Tennessee River criss-crosses right through those deposits.

Senator McKINLEY. I was talking about the Mississippi River.

Mr. WALDO. As a matter of general principle, there are certain classes of freight—marble for one, coal, iron, and other ore and timber products, sand, stone, and gravel and the like—which call for a low rate per ton-mile.

Senator McKINLEY. Is it not a fact that now the Government is spending $5,000,000 a year on the Mississippi, supposedly for navigation purposes, and taking in $2,000,000 of freight a year?

Mr. WALDO. That is probably true, Senator.

Senator McKINLEY. And that river has been in operation 100 years now.

Mr. WALDO. You have to consider what the history has been. You have not had commercial service on your boat lines. That is to say, if you have a factory, Senator, and you want to ship some goods, you can have a car spotted at your warehouse door, and you can put your freight on that car, and you know

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it will probably go straight to destination without any serious trouble. The river can not compete with that service unless it can offer some service that is equivalent to the advantages offered by the railroads. That can not be possible without adequate terminals and transfer facilities, and without the legislation that has only recently been passed to compel through bills of lading and physical connections between rail and river. The rivers have not had a chance yet, Senator.

Senator KENDRICK. It is your contention that before there can be real competition in the movement of freight there must be an eliminaion of all doubt as to the carrying capacity of the river and the connection in transportation, and all that sort of thing?

Mr. WALDO. Absolutely, Senator. You must have a competing service. You must be able to give a warehouse door to warehouse door service, and you have not been able to do that. The old-time boats that Senator McKinley mentions are the kind that used to tie up at any tree. If they had an empty chicken coop to land, it would make no difference whether it cost more to land that chicken coop than it was worth, they would land it just the same. There were no transfer facilities. They would put the goods on the river bank and a rain storm would come along and the goods would be ruined and the shipper would have no recourse whatever. Or a rise in the river would carry away a thousand dollars worth of hay or grain or some other material and the shipper would have to stand the loss. So there has never been a fairly comparable set of conditions between the river and the railroad.

To work out a comprehensive plan for the improvement of the Tennessee River, we must have an adequate survey. Such a survey has been proposed by the United States district engineer at Chattanooga, Maj. Harold C. Fiske.

The objects of this proposed survey are set up by Major Fiske in his request for the appropriation. I will read just a little of it:

"The proposal to make a comprehensive survey of the Tennessee River and its tributaries arises from the belief in the minds of many men who have given this matter careful thought that this basis is rich in undeveloped possibilities industrially and commercially. The industrial future is believed to rest primarily on the large amount of hydroelectric power which is potentially available both on the numerous large streams tributary to the Tennessee, which flow down from the mountains forming the rim of this basin and on the main river itself in its fall of 450 feet in the 430 miles from its source to the foot of Colbert Shoals. Second in importance only to this hydroelectric power, in the minds of these men, are the mineral resources of this region, covering a list of some 20 or 30 minerals known to exist in commercial quantities in this region, none of which have been thoroughly developed and only a few, such as coal, iron ore, marble, zinc, etc., appreciably developed. The commercial future depends in large measure on the transportation facilities by which this region is joined to the rest of the country. Of these, it is commonly accepted that existing railroad facilities are now, or soon will be, inadequate and that future extension on their part is not to be expected for many years to come."[1]

Then, of course, there is the cost of the service that you have to consider. A man never knows, when he establishes a plant whether the actual freight rate on which he is basing his present business is going to be the rate in the future at all. Over night it may be doubled and then what had been, apparently, a successful operation, may become an unsuccessful one.

Senator KENDRICK. May I ask a question there in connection with the freight on the Tennessee River?

Mr. WALDO. Certainly, Senator.

Senator KENDRICK. Is it the plan and purpose of those who have given this navigation matter a lot of thought, to have this freight move right out into the Gulf, or would it have to be transferred from one vessel to another when it reaches the mouth of the Mississippi?

Mr. WALDO. It would have to be transferred, Senator, but that could be done mechanically.

Senator KENDRICK. So that you have no boats on the river, then, that would carry cargoes on the Gulf?

Mr. WALDO. No, sir; not on the Tennessee River. The conditions on the Mississippi River in general are not such as to warrant operating ocean-going boats.

[1] Major Fiske's Report, H. Doc. No. 319, 67th Cong., 2d sess., p. 66.

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Senator KENDRICK. At New Orleans they do.

Mr. WALDO. They are planning to operate them as far up as Memphis, but that has not yet been done. As to New Orleans, I am sure you are right, Senator.

Senator KENDRICK. That is an important point in cheapening the general or through rate, if it could be done.

Mr. WALDO. Yes. The people on the Lakes have solved that problem, I think, in a very admirable way. You have probably visited the terminals at Toledo and the lower lake points, and have seen them transfer coal, for instance, from the cars to the barges. They will take a hundred-ton coal car, strap it down to a lifting platform, raise it by electric power, and spill the coal over the side of the car into an apron that connects with a chute leading down into the boat, and so transfer a trainload of coal from the cars to the boat in less than an hour. The whole work of unloading a car of coal is a matter of a few minutes.

The CHAIRMAN. Well, they do that down below Muscle Shoals, over the divide, on the Warrior River.

Mr. WALDO. Yes, sir; but not that way.

The CHAIRMAN. And do not do it that way, but they have mechanical means by which they can unload the coal from the car and put it in the barge or boat without the use of a shovel or any hand labor of any kind, and do it in a few minutes. But when you take it out of the boat and put it in a car, just the reverse operation, or take it out of one boat and put it into another, you have a different problem to solve.

Mr. WALDO. At Lorain, Ohio, for instance, on Lake Erie, they have to unload ore coming there in cargoes of five or six thousand tons, and they have installations all along the lake there which are marvelous to a man who is not familiar with those things. They can unload one of those enormous boats in about six hours by purely mechanical means, of course, using clamshell and orange-peel buckets and electric cranes. If it is small package goods, not bulk freight, then there are other means of doing it, as you have pointed out, Senator. You can put your less-than-cargo-lots goods into containers of sufficient size so that they can be loaded or unloaded by crane directly from the car to the barge.

The CHAIRMAN. We saw those when we were down there over on the Warrior River, where they seem to have developed up to date, large containers that were waterproof and big enough to put a man inside of. They would be filled and loaded on the cars, as I understand the operation.

Mr. WALDO. Yes, sir. Some of them would hold many men.

The CHAIRMAN. And an immense quantity could be put into one of those containers. Then a derrick would lift them off of the flat car and put them into the boat. It is a very simple operation.

Mr. WALDO. Yes, sir. The containers vary in size to suit the shippers' requirements.

The CHAIRMAN. Then they can be lifted off of the boat and put onto a truck or onto another car by a very simple operation.

Mr. WALDO. What we have in mind in connection with the Tennessee River, though, is bulk freight, heavy goods, that take a low freight rate and yield a low profit to the railroad company.

This report continues:

"It is therefore the hope of the local interests that the hydro-electric, industrial, and mineral resources of the Tennessee Basin may be rapidly developed and that as these develop the rivers of this region will be found to be in condition to carry freight between this basin and the rest of the valley of the Mississippi. When private interests seek to develop hydro-electric power in the Tennessee River Basin it is found here, and elsewhere, that questions arise as to the effect which the proposed installations will have on the navigable portions of these rivers, not to mention the ever-recurring question of what are the limits of these navigable portions.

"Furthermore, a large amount of this potential power lies in the Tennessee River itself, an undeniably navigable stream, where to be made available, this power must be developed by the United States or by other interests who have received from the United States certain definite and acceptable rights and privileges. Certain hydroelectric installations have been made in this basin, both on the tributaries above the head of navigation and on the main river itself, where navigation has also thereby been improved; yet it is felt by local interests that the delays, conditions, and uncertainties connected with

such developments have appreciably retarded the growth of this promising industry. It is the hope, then, of these interests that in the course of the proposed survey means will be found, not simply to remove everything in the nature of an obstruction to such progress, but even to facilitate and stimulate such enterprises. Hydroelectric power and native mineral resources suggest to manufacturing industries, and it seems to be expected that the proposed survey will, furthermore, point out a program of possible development which shall include such locations for the prospective plants as will insure the most efficient use of the navigable river system in its complete state of improvement which it is hoped will ultimately be attained. Finally, it is hoped that the information acquired in the course of the proposed survey will be sufficient in quantity and accuracy to enable prospective investors in power for manufacturing plants to dispense with much of the expensive investigation indespensible in launching undertakings in a comparatively virgin territory."[1]

I would like to call attention, in this connection, to the size of locks on the Tennessee, and I would like to put into the record a list of these locks, showing a comparison of the sizes.

Comparison of lock sizes, Tennessee River and Ohio River.

[From 1921 Report of Chief of Engineers, United States Army.]

Lock at—	Length (feet).	Width (feet).	Minimum depth on miter sills at low water (feet).	Remarks.
Tennessee River:				
Caney Creek	265	60	6.5	Not commenced.
Widows Bar	265	60	6.5	Under construction.
Bellefonte	265	60	6.5	Not commenced.
Hales Bar	267	60	6.5	Completed.
Riverton	287	80	6.25	Completed.
Dam No. 2	300	60	7.5	Under construction.
6 locks, Muscle Shoals Canal	275	57	2.2- 5	To be abandoned.
5 locks, Muscle Shoals Canal	283	57	3.5- 5	To be abandoned.
Ohio River, all locks	600	110	9- 11	Standard almost without exception.

The lock at Dam No. 2, for instance, is 300 by 60 feet, with a minimum depth of 7½ feet, but at Riverton, below that point, it is 287 by 80 feet, with a minimum depth of 6½ feet. At Hales Bar, above Dam No. 2, it is 267 by 60 feet, and the minimum depth is 6½ feet. This discrepancy in the locks will be a very distinct disadvantage when it is undertaken to navigate the stream, using self-propelled barges.

The CHAIRMAN. Well, we can not remedy that. I have realized that for some time, and have been looking into it. I first thought it was a very serious handicap. I even thought that we ought to change the plans of Dams No. 2 and 3 and make the locks larger, but I have talked with the engineers about it and they have satisfied me it is not so important as I thought it was. For instance, the object in having a large lock is to put several barges in the lock at once. There will be no boats that will go up and down that river that can not be handled in all those locks. There will be one boat, perhaps, pulling half a dozen barges.

Mr. WALDO. They push five or six small barges of two or three hundred tons capacity.

The CHAIRMAN. When they come to a lock that is big enough to put them all in, they will all go through at once. When they come to a lock that will not take but half of them, they will have to have two lockings. It will take a little longer; that is all. There is not any reason now that would justify the Government in tearing out the locks and putting in bigger ones.

Mr. WALDO. Not now. However, we are simply pointing out the inconsistency in building a variety of sizes of locks rather than determining on a definite, comprehensive plan that looks ahead somewhat, as would be provided by this survey, Senator.

[1] Same reference.

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The CHAIRMAN. Of course, that is right, Mr. Waldo. There is no doubt about that. But so much work has been done without any definite plan, and it would have been a lot better before we did anything to have had a comprehensive plan to develop the entire stream. But that has not been done, and we can not help it.

Mr. WALDO. In contrast with that consider the Ohio River, with 54 locks, all of which are 600 by 110 feet. They evidently have a definite plan.

The CHAIRMAN. Yes.

Mr. WALDO. All their boats can be based on 600 by 110 foot locks. If those boats are to be built after the manner of the self-propelled barges of the Mississippi-Warrior service, a boat based on the Ohio River locks could not use the Tennessee River except on the part near the mouth.

The CHAIRMAN. I will ask you this question. You perhaps know, and I don't. Are there any boats now navigating the Ohio and Mississippi that could not pass through the locks that we have started at Dam No. 2?

Mr. WALDO. I do not know of any, Senator. However, the adoption of 600-foot locks in the Ohio River with a 9-foot depth, and not over 300-foot locks in the Tennessee with a 6-foot depth seems to indicate that the Tennessee is hardly receiving due consideration.

The survey which we desire has been recommended by the Chief of Engineers, Gen. Lansing H. Beach. There was great satisfaction throughout the Central West when General Beach became Chief of Engineers. His many friends have felt that here is a man who understands the needs of inland river navigation and appreciates what a real commercial development of river traffic requires and what it will do in building up the industries of a rich and comparatively undeveloped region. He appreciates the fact that power development should go along with navigation improvement wherever possible, and in recommending an appropriation of $250,000 for continuing the work of the survey General Beach said: "In these days of superpower the direct effect of the power development possible on these streams will reach to every part of the country east of the Mississippi and the economic result will be manifest throughout the entire extent of our country.[1]

General Beach's recognition of the importance of power studies in connection with navigation improvement is gratifying to many people who wish to see our navigable streams and their tributaries fully utilized. At Muscle Shoals, and undoubtedly in many other cases, by setting up a long-term sinking fund the water power can be made to pay the whole cost of the navigation structure, Senator. That is the idea of that feature in the Ford proposal; you will amortize not only the cost of your dam, but your locks as well, and ultimately the Government receives its navigation facilities free of cost. We believe that wherever the power development is worth while, if the time of the lease is sufficiently long, an amortization fund can be set up at such low cost that it will not add appreciably to the cost of the power to this generation of consumers, and it will give future generations very cheap power, and also the navigation improvement without cost. Furthermore, the results have not been at all as Colonel Harts predicted. In the Knoxville district, in spite of the great hydroelectric developments, there has been a serious shortage of power rather than any lack of market, for example, there are knitting mills where a long line of girls are employed, and the power goes down suddenly, due to a shortage, because, perhaps, of the local power people having oversold their supply of current. When the power suddenly goes down the operator does not know whether to let these girls go home or to keep them there and pay them without getting any return.

Another man will have cloth passing through a long vat containing dyestuffs; he is depending on a certain rate of procedure through that vat in order to secure a certain color, and the power suddenly is gone and a large part of his cloth is ruined. The expense for power is not alone its present comparatively high cost, but the damage and loss resulting from lack of continuous service.

The examples can be multiplied of those industrial developments up and down the Tennessee Valley depending on hydroelectric power where there has been a power shortage, and right to-day there are people in Knoxville, for instance, who would be very glad to form a company to develop some of these cheaper powers. We would have no difficulty in the world in securing capital for such a purpose, but those interested know and we know that until there is such a survey as this it is useless for them to proceed. The dams are on

[1] H. Doc. No. 319, 67th Cong., 2d sess., p. 3.

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navigable streams, and a plan must be worked out in cooperation with the Government covering both power and the navigation features. To say that a strictly navigation survey such as this one of Colonel Harts of 1909 will suffice to-day is to talk nonsense.

On that map before us there is a large blue spot that shows 144,000 horsepower. About 72,000 horsepower of that is already installed on the Little Tennessee River at the Cheoah Dam and the Alcoa project has been started, but has not yet been carried very far. That demonstrates what private capital will do when it does not have to consider navigation. They went to the Little Tennessee River simply because it was not a navigable stream and they would not have to consider Government cooperation. The remainder of those streams, the important ones, are officially declared to be navigable, and until we can have a navigation-power survey by the Government engineers that is of the same character as this Muscle Shoals survey—Document 1262 of the Sixty-fourth Congress, first session—will we be unable to proceed with any plan.

In this connection I would like to read an extract from the hearings before your committee, Senator, on April 11. Col. W. J. Barden, United States district engineer in charge of the Florence district at Muscle Shoals, said:

"Major Fiske tells me that his report is not yet ready for the commission, and this is merely preliminary information he is giving now. He says there are feasible 46 combined reservoir and power dam sites available, each having a draw-down capacity varying from 5,000 to 800,000 acre-feet. The two largest, with capacities of 700,000 and 800,000 acre-feet, respectively, are located on the Clinch River, and he thinks that if their draw down were properly regulated in the interest of the Muscle Shoals dams, the minimum flow, and therefore the primary power, would be about doubled for an average year."

The CHAIRMAN. Where is that on this map?

Mr. WALDO. It is here at these upper river Dams Nos. 3 and 5, Senator. Dam No. 3, with reasonable expense, could be built up to a height of 235 feet and eliminate Dam No. 2. That would give a storage of some 222,000,000,000 cubic feet, or about 5,100,000 acre-feet, according to the preliminary studies that we have made. If that Dam No. 3, together with the one on the Holston numbered 5 and the one on the Hiwassee numbered 17, were built, there is no doubt whatever that the primary power can be doubled at Muscle Shoals, and probably more than doubled.

The CHAIRMAN. Are those water-power propositions or purely storage?

Mr. WALDO. Those are water-power propositions, because they are on navigable streams, and there is a certain amount of water which must be allowed to flow continually and, that being true, of course the logical thing to do is to install hydroelectric equipment at the dams and generate power for local purposes. Knoxville is especially interested in this because that is a chance to get additional power in that section.

The CHAIRMAN. Now, that is interesting. You want Mr. Ford to have this. Knoxville won't get any power from Muscle Shoals if Ford gets it.

Mr. WALDO. Probably not.

The CHAIRMAN. Because Ford is going to use it all himself. You say Knoxville would get power if you developed Dam No. 3?

Mr. WALDO. Undoubtedly, Senator.

The CHAIRMAN. But if we give it to Ford, like you want us to give this to Ford, Knoxville would not get any power then from Dam No. 3, would it?

Mr. WALDO. I don't see why not, because——

The CHAIRMAN. How far is Knoxville from Dam. No. 3?

Mr. WALDO. Twenty-five miles, air line.

The CHAIRMAN. Exactly. Now, if we give away the power at Dam No. 3 up there in the headwaters up there, on the same basis that you are wanting us to give this away at Muscle Shoals, Knoxville would not get a horsepower.

Mr. WALDO. This Clinch River Dam No. 3 would come under the water power law, Senator.

The CHAIRMAN. But he could build another city up there like Ford is going to build, and go into his own business, and the people would not get any of it.

Mr. WALDO. No, sir. Let me make this statement: At Muscle Shoals we have a peculiar condition. We do not have the ordinary water-power proposition. Mr. Ford is undertaking, over a period of a hundred years, to do certain things that the ordinary water-power development does not undertake to do.

The CHAIRMAN. What is it?

Mr. WALDO. He is undertaking to maintain the nitrate plant, absorbing all depreciation himself, during a period when the plant will have to be re-

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built probably four or five times. He is undertaking to manufacture to the full capacity of that plant nitrogen fertilizers and other commercial fert lizers that will call for phosphoric acid and potash in sufficient quantities to make up a commercial fertilizer mixture.

The CHAIRMAN. He does not agree to do that.

Mr. WALDO. I will read this paragraph, Senator.

The CHAIRMAN. I don't think it would be very material even if he did, however, because that is taking all the power away from any city that may want it, absolutely. But, of course, the power at Muscle Shoals to operate nitrate plant No. 2 is very small as compared with the immense amount of power that is going to be developed at those two dams.

The point I wanted to call your attention to was that at Muscle Shoals, if Ford's offer is accepted, while it would be a great thing for the people who own the lots and the real estate to sell it and for the people in the immediate vicinity, because it will build up a city—I think, without any doubt, a great manufacturing center—all the electricity developed there, except what is used to run nitrate plant No. 2, is Ford's—all of it.

Mr. WALDO. Such as it is, and under restrictions.

The CHAIRMAN. And he is not going to sell it to anybody. There is no restriction about the electricity that he has.

Senator HEFLIN. Let him read that clause.

The CHAIRMAN. Now, the contest on that point of it is between the idea of giving the power all to one man to use in the manufacture of anything he wants to go into, and the other idea that when we develop power on a navigable stream it ought to be given more directly to the people, like cities and towns, and carried on to New Orleans and Little Rock, Ark., and all such places as that.

Mr. WALDO. I appreciate your point, Senator, but I want to set up the other side. It never has been set up, and I don't believe it is understood.

The CHAIRMAN. I would be very glad, of course, to have you make any argument you want to on that line, but, Mr. Waldo, there are two ideas, now, on this question of power development, and I am not condemning either one. For instance, the complaint is made now in Buffalo that the people of Buffalo, the householders—and one great advocator of Ford was always talking about the washerwoman getting power to run her washing machine—are talking and complaining that they are living near enough to hear the water roll over the falls, and they get no benefit from it themselves, and they use electricity made by coal that is hauled in hundreds of miles on the railroad.

Mr. WALDO. Yes.

The CHAIRMAN. That has been given to manufacturing concerns. It has helped them and it has helped the country. I will admit that. But the question is whether it would not have been a greater benefit—at least, this other school believes it would, and I confess I am a member of it—instead of turning it over to one man or one set of men to use in their private business to have it distributed all over the country, because it belongs to all the people and ought to be carried just as far as electricity can be carried.

Mr. WALDO. What is the best way to carry it farthest, Senator, by wires?

The CHAIRMAN. By wires.

Mr. WALDO. I can't agree with you, Senator.

The CHAIRMAN. If there was a better way, I would like to see it carried that way.

Mr. WALDO. Suppose you are able to put that into concentrated fertilizers, and suppose you are able to carry that long distances, far beyond the range of the economical electric transmission. Are you not benefiting to a far greater extent the population of this country than you are merely to distribute it over a limited territory of 300 miles radius or less.

The CHAIRMAN. You will put some of it into fertilizer, probably, at Muscle Shoals?

Mr. WALDO. Two hundred thousand horsepower, in all probability, Senator.

The CHAIRMAN. No, not that much; less than 100,000, under Ford's offer. That is all that the Government would probably put in if it operated it. I am not complaining about that. And it would do lots of good. I am not complaining about that. That is going to be done down there, I suppose, no matter who handles it, because it belongs to the Government and must be kept as a war preparation, and the question is how we can use it best in time of peace. That limitation will probably be put on anybody, whether the Government does it or anybody else does it. I do not suppose that Congress would ever

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give that up, because we need that. We need to operate that plant if war should break out, and we want to use it in time of peace to make fertilizer.

Mr. WALDO. Yes, sir.

The CHAIRMAN. Now, outside of that, in Mr. Ford's offer he owns all of the electricity that is developed.

Mr. WALDO. But what kind of electricity is it? It is electricity that, to be made useful, will call for the large expenditures of his own personal funds, because it is of such an irregular and unreliable nature.

The CHAIRMAN. Certainly. That same thing applies to Niagara Falls. In order to make it useful those men who buy it put in millions of dollars in the erection of machinery.

Mr. WALDO. But not to regulate the flow of the stream, Senator. Mr. Ford must invest millions in equipment, and the other millions in regulation works to stabilize the stream flow. In the Niagara River the minimum flow is 80 per cent of the maximum flow. In the Tennessee River at Muscle Shoals the minimum flow is about 1.4 per cent of the maximum flow. The conditions are not the same at all.

The CHAIRMAN. But the people, the ordinary folks, are complaining about it now because they feel as though that is a national proposition, and they ought to get it directly to use to light their homes and run their washing machines and ironing boards.

Mr. WALDO. That is not our viewpoint of it.

Chrome steel, that makes possible high speed lathes and increased output in our factories is an important thing, Senator; so are artificial quick-cutting abrasives such as carborundum and alundum; so is aluminum, chlorine, bleaching powder and the 60 or 70 other products of electro chemistry and electric furnace metallurgy. Those are key industries, Senator. As a national policy, unless we build up those key industries we are going to let other nations get ahead of us in a very vital matter in time of war. Our attitude is that the woman with the washing machine has a place in the national program, but not the place nor the claim that the electric furnace has.

The CHAIRMAN. The woman with the washing machine has a place on the program, but she has got to pay for it at a high rate. She has got to use electricity made from coal to run her washing machine.

Mr. WALDO. How much does that amount to to her in a year's time compared for instance, with the annual fertilizer expenditure of an average fertilizer-using farmer, Senator?

The CHAIRMAN. I am assuming that we are going to make fertilizer. That is needed. The Government is going to do that. But I am only taking the point as to the excess that is left after that is done.

Mr. WALDO. All right.

The CHAIRMAN. The power that is going to be used to make fertilizer will not be one-fourth or one-fifth of the power that is going to be developed, if we utilize the power in the Tennessee River as I think we ought to.

Mr. WALDO. I am not so sure as to that. On the other hand, Mr. Ford utilizes Dam No. 3 and this Dam No. 5 in connection with Muscle Shoals, although they do not appear in his offer, and they would not come in under a special act of Congress, as Muscle Shoals does, but they would come in under the ordinary water power law, and the power rights would have a life of 50 years. It would come under the regulations of the State of Tennessee and would be distributed to the industries of that section, with the idea that by doing so Mr. Ford can get cheaper power at Muscle Shoals. Under the water power law what would happen? Every downstream improvement that benefits by a head-water improvement has to bear its fair share of the cost of the head-water improvement. The Muscle Shoals project would have to bear its share; Hales Bar would have to bear its share; Chattanooga, which receives a distinct benefit because of floods and I would like to put into the record the record of floods at Chattanooga, because Colonel Harts declares that there are no questions of flood control on the Tennessee River that call for consideration), would have have to come in and bear its share, and the local power generated would have to bear its share. Combined in that way, they would have a very much less expense than what any one of them would have to bear if making such a development individually.

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Tennessee River at Chattanooga, Tenn.

[Flood stage, 33 feet. Weather Bureau records.]

Date.	Stage.	Date.	Stage.
Mar. 11, 1867	57.7	Mar. 14, 1897	38.2
Mar. 1, 1875	53.6	Mar. 22, 1899	40.0
Jan. 15, 1879	38.0	Dec. 31, 1901	39.5
Mar. 19, 1880	38.3	Jan. 2, 1902	40.8
Jan. 19, 1882	40.2	Apr. 11, 1903	31.8
Jan. 23, 1883	38.2	Nov. 22, 1906	33.3
Mar. 10, 1884	42.8	Mar. 30, 1913	33.3
Apr. 3, 1886	52.1	Dec. 28, 1914	33.1
Feb. 18, 1889	34.6	Dec. 21, 1915	34.4
Mar. 2, 1890	42.5	Jan. 1, 1916	32.9
Mar. 11, 1891	38.9	Mar. 7, 1917	47.7
Jan. 17, 1892	37.9	Feb. 2, 1918	42.5
Feb. 20, 1893	33.4	Apr. 5, 1920	43.6
Apr. 5, 1896	40.5	Jan. 24, 1922	35.8

"April, 1886, Chattanooga city was surrounded by water; fifth ward almost entirely submerged; waterworks shut down owing to flood extinguishing the fires. Both gas works suspended operations and business of all kinds was suspended. Several persons were drowned and many on the outskirts of the city had their homes washed away. Gauge height 52.1. Danger point on gauge, 33 feet.

"March, 1899, flood warnings were also sent to all points as far as Cairo and given the widest possible distribution. On the morning of the 20th Knoxville reported a rise of 10 feet, reaching 27.4. This indicated that the river at Chattanooga would reach 42 feet by the morning of the 22d. The forecast was prepared accordingly and all persons interested were notified to move their goods. Persons moved out of their houses on the 20th—all merchants and factories having goods under the 40-foot mark moved them at once on advice from the office, etc. As far as can be ascertained the amount of property saved as a result of the warnings given was something over $200,000." (Etc.) (Extract from record of United States Weather Bureau.)

NOTE.—The Weather Bureau officer in charge of flood records estimates that the damage done is never less than three times the value of the property saved as a result of their warnings.

"Twice within less than a year a large part of the city has been flooded. Unless some steps are taken to prevent such floods, Chattanooga's future as an industrial city will be destroyed." (Chattanooga-Hamilton County Flood Prevention Association, 1917.)

DEPARTMENT OF COMMERCE,
OFFICE OF THE ASSISTANT SECRETARY,
Washington, July 5, 1922.

Mr. W. G. WALDO,
205 Third Street SE., Washington, D. C.

DEAR MR. WALDO: Referring to our discussion on floods of the Tennessee River as to their damage at the various cities, I prefer to confine my confirming remarks to one single city of industrial importance, namely, Chattanooga, where I have lived for somthing over 20 years, and can speak from first-hand experience.

From the table of floods as compiled by the Engineer Corps, United States Army, attached hereto, you will have observed that they reckon the flood stage at 33 feet, which they designate as the "danger point," and that there have been 28 such floods from the time the Government began keeping records of this stream in 1867 to January 24, 1922 (there have been at least two since the latter date, but they are not shown in the figures of the War Department yet available). You will also note that speaking of comparatively modern times, namely, December, 1901, to date, there have been 12 such floods. In other words, for the whole period, or in a 20-year period, they are shown to recur at the short intervals of only two years.

You ask particularly regarding the 1917 flood, when the river reached a stage of 47.7 feet, and effect of this flood at Chattanooga. First of all, let me call your attention to the attached table again, from which you will observe that in

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every instance these floods occur at the worst possible season of the year, viz, between December and April at the latest, and chiefly in the coldest months of the year when the greatest amount of misery and privation is caused to those who are driven from their homes.

In this 1917 flood, which was accurately predicted some days ahead by the Weather Bureau, the mayor of the city organized leading citizens into a flood relief committee, on which the writer served in raising tens of thousands of dollars for such relief. The headquarters were in the city hall, which was kept open night and day for many days, and from which were dispatched in the early days all the automobiles and trucks of the city, which were drafted from private ownership to the rescue work. As the flood increased these were necessarily abandoned in favor of launches, improvised boats and rafts, with which the rescue work was continued. All of the public schools and principal churches were thrown open to house the tens of thousands of refugees. There mattresses, so far as possible, and food were supplied throughout a number of days and nights. It was, of course, impractical, except in a few cases, to move the furniture and heavy belongings, most of the effort being directed to the actual rescue of persons and of their immediate needs, such as clothing, leaving in most cases the complete house furnishings, such as rugs, pianos, and furniture generally, all of which were entirely submerged by water, and, worse yet, caked with mud when the waters receded.

It is impossible to put a money value on such damage because quite generally manufacturers and other business men, as well as private citizens, have such a strong civic pride that these things are kept quiet because of the competition between cities.

As a result of this flood, however, the city jointly with civic bodies, such as the chamber of commerce, employed eminent civil engineers to study the problem, and this organization has estimated that in the case of the 1917 flood there were 8,000 homes submerged (in hundreds of cases which I have noted myself nothing but the chimney being visible). Allowing the usual census multiple of five persons per home, this would seem to indicate that in that flood 40,000 people were driven from their homes. Without trying to put it into dollars you can figure for yourself in the case of your own home what it would cost if the house stood for from three to five days under water, with the loosening of the plaster and other destruction to the building, not to talk of its furnishings.

There should also be borne in mind the fact that such floods cause almost complete suspension for railroad service in or our of the city, and interference to United States mail, of course, paralyzing the deliveries of mail and suspending delivery of food, supplies, etc.

It is estimated that there are 20,000 wage earners in the city and suburbs, and if their average wage were $3 per day this would mean a loss in wages of $60,000 a day.

Chattanooga is credited with an annual value of manufactured products of $124,000,000, which equals $413,000 per day. Hence the loss to manufacturers for a five-day flood would be about $2,000,000.

Such figures, of course, do not include actual damage by flood, such as by spoiled materials—raw, in progress, or finished—nor the enormous damage to machinery and equipment, nor undermining of buildings and other structures, etc. For example, in the 1917 flood the direct financial loss to the O. B. Andrews Paper Mills Co. due to spoilage of raw material was stated to be $65,000, and I recall another manufacturer whose similar loss was $100,000. But, as I have said above, accurate figures are difficult to obtain, because of the universal feeling that it is disastrous to the city to advertise to competing cities what the effects of these floods are.

Much could also be said about the pitiful effects on those farmers in the adjacent territory who are unorganized and unable to give voice to the extent of their damage and misery; but if you had been through one of these floods and had seen the frantic efforts to remove chickens, cows, pigs, and other live stock on improvised rafts to places of safety, you would realize the privation and trouble caused these people, especially when you consider the difficulty of arranging to feed and care for such live stock during the entire period of a flood.

With regard to health, the sewers of the city, of course, empty into the river, and at these extreme stages are put out of commission, resulting in the effluent being washed back and deposited over the area that is inundated. Serious con-

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sequences to the community are only avoided by the most drastic rules of the health department, which forbid reoccupation of homes until they have been limed and other precautionary measures carried out; but this denial to property owners to reenter their premises is an additional hardship, most easily comprehended when you consider the season of the year and what it means in families where sickness is present, etc.

Herewith I attach an aerial photograph made by the local street railroad system at the time of the 1917 flood, from which you will note that fully three-fourths of the city was under water at a stage of 47.7. If you will now consult the table compiled by the Engineer Corps, you will see that in 1867, in 1875, and in 1886 there were much higher floods, ranging from 52.1 to 57.7. Of course, in those days the city was a mere village, but it is unpleasant to contemplate what would be the loss in life and property, if there should be a similar flood, based on the present population.

If I can serve you further in this connection, let me know.

Sincerely yours,

PAUL J. KRUESI.

If I may at this time, I would like to put in paragraph 15 of the Ford offer, in regard to the manufacture and distribution of commercial fertilizers to the farmers.

The CHAIRMAN. All right.

Senator KEYES. Paragraph 15 of the Ford offer?

Mr. WALDO. Yes, sir.

"15. Since the manufacture, sale, and distribution of commercial fertilizers to farmers and other users thereof constitutes one of the principal considerations of this offer, the company expressly agrees that continuously throughout the lease period, except as it may be prevented by reconstruction of the plant itself, or by war, strikes, accidents, fires, or other causes beyond its control, it will manufacture nitrogen and other commercial fertilizers, mixed or unmixed, and with or without filler, according to demand, at nitrate plant No. 2 or its equivalent, or at such other plant or plants, adjacent or near thereto as it may construct, using the most economical source of power available. The annual production of these fertilizers shall have a nitrogen content of at least 40,000 tons of fixed nitrogen which is the present annual capacity of nitrate plant No. 2. If during the lease period said nitrate plant No. 2 is destroyed or damaged from any cause, the company agrees to restore such plant within a reasonable time to its former capacity, and further agrees:

"(*a*) To determine by research whether by means of electric-furnace methods and industrial chemistry there may be produced on a commercial scale fertilizer compounds of higher grade and at lower prices than farmers and other users of commercial fertilizers have in the past been able to obtain, and to determine whether in a broad way the application of electricity and industrial chemistry may accomplish for the agricultural industry of the country what they have economically accomplished for other industries, and if so found and determined to reasonably employ such improved methods.

"(*b*) To maintain nitrate plant No. 2 in its present state of readiness or its equivalent for immediate operation in the manufacture of materials necessary in time of war for the production of explosives."

Senator HEFLIN. Is that the part you spoke of reading a while ago?

Mr. WALDO. Yes, sir. I will not read it all. It simply provides that Mr. Ford is to manufacture nitrogen and other commercial fertilizers, mixed or unmixed, and with or without filler, according to demand. If the farmers demand a 2–8–2 fertilizer, which is a customary mixture, that calls for four times as much phosphoric acid as nitrogen, and as Mr. Ford must produce annually at least 40,000 tons of nitrogen, he must be prepared to manufacture 160,000 tons of phosphoric acid.

The CHAIRMAN. I concede that, and I have an idea he will do it; but there is not anything in that that compels him to do it. "According to the demand." Who is going to determine what the demand is? I do not care to argue it now, but there are a thousand ways in which this corporation, not Ford, but the corporation after Ford is dead, 25 years from now, can get around that provision. This corporation will say there is no demand. "We will make the nitrogen. We comply technically with the contract." That is all we can expect them to do.

Mr. WALDO. But it says, "and other commercial fertilizers according to demand"—of the consumers, of course.

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The CHAIRMAN. Yes; it says, "other commercial fertilizers"; but if they make this nitrogen they say there is not any demand, and who is going to say whether there is a demand or not? They can say, "We will turn this over to somebody else, and somebody else will make it into fertilizer," and that may prove very satisfactory. I do not say that it will not. I am not making complaint about it. I am only calling attention to the fact that it is too general, as there are a good many things in Mr. Ford's proposition, and when you come to dealing with the corporation, as we will have to deal, they will take advantage—and we can not complain if they do—of every technicality that may be in it.

Mr. WALDO. Paragraph 16 goes on to set up an organization to see to it that these fertilizer obligations shall be carried out.

The CHAIRMAN. That is the paragraph which says there shall be a board?

Mr. WALDO. Yes, Senator.

"16. In order that farmers and other users of fertilizers may be supplied with fertilizers at fair proces and without excessive profits, the company agrees that the maximum net profit which it shall make in the manufacture and sale of fertilizer products shall not exceed 8 per cent of the fair actual annual cost of production thereof. In order that this provision may be carried out the company agrees to the creation of a board of not more than nine voting members, chosen as follows: The three leading representative farm organizations, national in fact, namely: The American Farm Bureau Federation, the National Grange, the Farmers' Educational and Cooperative Union of America, or their successor or successors—said successor or successors to be determined, in case of controversy, by the Secretary of Agriculture—shall each designate not more than seven candidates for said board in the first instance, and thereafter, for succession in office, not more than three candidates. The President shall nominate for membership on this board not more than seven of these candidates, selected to give representation to each of the above-mentioned organizations, said nominations to be made subject to confirmation by the Senate, and there shall be two voting members of said board selected by the company: *Provided*, That not more than one shall be nominated by the President from the same State; that if the Senate shall not confirm all of said seven nominees the President shall send additional names from the said list of candidates until the Senate shall have confirmed seven: *Provided further*, That if either or any of said farm organizations, or its or their successors, by reason of the expiration of its or their charter or ceasing to function or failing to maintain its organization or for any cause or reason should decline, fail, or neglect to make such designations, then the Secretary of Agriculture shall make such designation or designations for such or all of said organizations as may so decline, fail, or neglect to make such designation; and if such designation is made by the Secretary of Agriculture for only one or two of said organizations, then such designation shall be made so as to give the remaining organization or organizations the same right and in the same proportion to designate candidates for said board as in the first instance and just as though all of said organizations were making such designations: *Provided, however*, That a failure to make designations at any one time shall not thereafter deprive any organization of its original rights under this section: *And provided further*, That the terms of office of the first seven candidates nominated by the President and confirmed by the Senate on the designation of said farm organizations shall be as follows: Two for a period of two years, two for a period of four years, and the remaining three for a period of six years, and thereafter the nominations for membership on said board made by the President, except for unexpired terms, shall be for six years each. None of the members of said board shall draw compensation from the Government, except that any which may be nominated and confirmed on the designation of the Secretary of Agriculture under the provisions hereof shall receive from the Government their actual expenses while engaged in work on said board. A representative of the Bureau of Markets, Department of Agriculture, or its legal successor, to be appointed by the President, shall also be a member of the board serving in an advisory capacity without the right to vote. The said board shall determine what has been the cost of manufacture and sale of fertilizer products and the price which has been charged therefor, and, if necessary for the purpose of limiting the annual profit to 8 per cent as aforesaid, shall regulate the price at which said fertilizer may be sold by the company. For these purposes said board shall have access to the books and records of the company at any reasonable time. In order that such fertilizer products may be fairly distributed and economically purchased by farmers and other users thereof, the

said board shall determine the equitable territorial distribution of the same and may in its discretion make reasonable regulation for the sale of all or a portion of such products by the company to farmers, their agencies, or organizations. If and when said board can not agree upon its findings and determinations, then the points of disagreement shall be referred to the Federal Trade Commission (or its legal successor) for arbitration and settlement, and the decision of said commission in such cases shall be final and binding upon the board.

The CHAIRMAN. And the Farm Bureau and the Grange and some other farm organizations are going to nominate representatives or suggest them to the President.

Mr. WALDO. Yes, sir.

The CHAIRMAN. To my mind, I would have thought a great deal more of Mr. Ford's offer if he had omitted that. I think it can not be considered to be anything else than a bid to those fellows in Washington who represent these farm organizations to get their organizations behind Ford's offer, and that is just what has happened. And when you think this is to last a hundred years, the idea of the Farm Bureau existing for a hundred years, or even the National Grange! The probabilities are that they will be out of existence in 10 years. They may live for a hundred. That would be the object of this great corporation owned by Wall Street in a few years after Mr. Ford died. They would have possession of these farm organizations overnight. To my mind it is worse than nothing to put that in there, because we can not conceive of what these organizations are going to be in 50 years from now or a hundred years from now.

Mr. WALDO. I will agree that perhaps not one of the three organizations, whose representatives constitute the majority of the board, will live 100 years. But they will have successors. That means that Mr. Ford's company deals, not with this or that particular farm organization, but with organized agriculture, the permanence of which there can be little doubt, for whatever else fails in this country agriculture must not fail, whatever happens. Furthermore, if there is no regulation whatever, then how are you to be assured that the profit is limited to 8 per cent?

The CHAIRMAN. I think that is a very proper thing to consider, but it seems to me that to do a thing of that sort would not mean certainty, but it would be as near as we could come to it. If we wanted to provide for that, it ought to be under the jurisdiction of some governmental authority that we know is going to stay as long as the Government exists, unless we change our form of government.

Mr. WALDO. I am willing to leave it to the farmers, Senator. Without taking the time to read this, I wish to put into the record what General Beach has to say with regard to these reservoirs and what might be accomplished by them.

"General BEACH. Every dam that is built on the upper Tennessee which will restrain the flood waters and let them out gradually during the low-water season will increase the primary power at Dam No. 2, with a corresponding decrease in the secondary power. Mr. Ford has said that if he obtained the lease of this property at Dam No. 2, or the lease of the property according to his proposition, he intends to come in and make application for other dams on the upper river and develop them up there above with the idea of utilizing the power which he can obtain from them and increasing the value of the power which he has made arrangements to obtain by his offer at Dam No. 2. That one feature of the case alone appears to me to be worthy of the most careful consideration by Congress, for I believe that the leasing of Dam No. 2 to Mr. Ford will be followed by a development along the Tennessee River which would be very material, and would probably amount in a few years to more than you would get in any other way in the course of a generation or two."[1]

The CHAIRMAN. All right.

Mr. WALDO. Then I want to follow that with what Major Fiske, the district engineer, hopes to accomplish by means of these same reservoirs. We all know what is expected to be accomplished.

"Existing information indicates that by building the two dams on the Clinch River, which give the maximum storage of any possible in this basin, the primary power at Muscle Shoals might be doubled, and that by building still other dams on various tributaries the primary power at Muscle Shoals might be brought up to nearly three times what seems possible under present condi-

[1] House Hearings on Muscle Shoals Propositions, 67th Cong., 2d sess., p. 104.

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tions. There is already one power-navigation dam in operation on the Tennessee River and others seem to be worthy of serious consideration.

"It is to be remembered that these dams on tributaries permit the generation of power at their own sites, the increase of primary power at Muscle Shoals, and also a similar increase at from one to all of the other power-navigation dams which may be built on the Tennessee proper. For instance, the water stored on the Clinch River would generate power there, and in addition, if future investigation should remove a variety of known obstacles of unknown seriousness, the same water would participate six times in the generation of power at as many different power-navigation dams before reaching the turbines in the Muscle Shoals section."[1]

The CHAIRMAN. Is that in this report which has not yet been printed?

Mr. WALDO. That has not been printed; no, Senator; I have the proof sheets.

The CHAIRMAN. I have not seen it, and it is very interesting to me, because it is the one study that, it seems to me, we lack in order to legislate properly on this whole thing. I agree with you entirely that we ought to consider it all, and that that is very important, because it will lessen the cost of power a great deal if it is practical to build those dams. Does the report recommend the building of those dams?

Mr. WALDO. The report recommends a thorough investigation of them, and the Chief of Engineers recommends an authorization of $515,800 and a present appropriation of $250,000 for this investigation and survey.

The CHAIRMAN. Has the examination gone far enough so he gives an estimate of the cost?

Mr. WALDO. He does not, Senator.

The CHAIRMAN. He does not do that?

Mr. WALDO. No; he does not do that.

The CHAIRMAN. It is just a preliminary?

Mr. WALDO. That is all. I have been on the ground and I know there is no such undertaking required as at Muscle Shoals. The dam, for instance, at the site indicated at No. 3 would be about 1,500 feet long on top, but the base, where the greatest thickness of the cross section is required, would be only about 300 feet long.

The CHAIRMAN. That is on the Tennessee proper, is it not.

Mr. WALDO. That is on the Clinch River, just below the mouth of the Powell River.

The CHAIRMAN. Where does the Clinch River flow into the Tennessee?

Mr. WALDO. Just below the point marked 4 on the map, at a place called Kingston, Tenn.

The CHAIRMAN. And Knoxville is between Dam No. 2 and——

Mr. WALDO. Knoxville is that large red spot on the map.

The CHAIRMAN. Is the Clinch River navigable?

Mr. WALDO. Yes, sir. That is, it is declared to be a navigable stream.

The CHAIRMAN. I do not have any idea that there is much navigation up there. Is not that pretty well up in the mountains?

Mr. WALDO. Yes, sir. Navigation in fact is quite a different matter.

Senator KEYES. I think the water power commission considers any stream that will float logs a navigable stream.

The CHAIRMAN. It would probably have to go through the formality of putting in locks, then?

Mr. WALDO. That is a question that would have to be decided. The Army engineers would say as to that. I expect that it would be a good thing.

The CHAIRMAN. How high would that dam have to be? Does he recommend it, or does the survey recommend the height?

Mr. WALDO. This report gives certain heights for the dams and the capacities for the given heights. A dam at site No. 3, for example, 175 feet high would have a storage capacity of about 64,000,000,000 cubic feet, but if carried up another 60 feet you would increase it from 64,000,000,000 to 222,000,000,000, and by far the greater part of the area that you would cover is cut-over timber, and is not agricultural land.

The CHAIRMAN. How is it settled?

Mr. WALDO. It is very sparsely settled.

The CHAIRMAN. Is there any town up there?

Mr. WALDO. The town of Clinton just below the site of dam No. 3 is the nearest town.

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[1] H. Doc. 319, 67th Cong., 2d sess., p. 154.

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The CHAIRMAN. That would be flooded, the whole town?

Mr. WALDO. No, sir; There would be no damage to towns whatever.

The CHAIRMAN. There would not be?

Mr. WALDO. No, sir.

The CHAIRMAN. I should think it would be a practical proposition, then.

Mr. WALDO. Everyone has considered that it probably would, Senator.

The CHAIRMAN. That dam No. 3 would back the water up in two rivers?

Mr. WALDO. Yes; both the Powell and the Clinch, nearly up to the Kentucky line.

The CHAIRMAN. How many miles?

Mr. WALDO. I judge possibly 45.

Let us consider for a moment the cost of primary power to Mr. Ford if he does not do this thing. There is nothing in his offer here that compels him to do this. Just why should we expect him to do it?

The CHAIRMAN. There is not anything in his offer that even mentions it.

Mr. WALDO. Why should he be expected to do it, then? Colonel Barden, in his testimony, indicated that the primary power at the two dams at Muscle Shoals totals 121,000 horsepower. He gives the estimate of the cost of completing those dams as $50,000,000.

The CHAIRMAN. How much primary horsepower?

Mr. WALDO. One hundred and twenty-one thousand. That is 87,000 at dam No. 2 and 34,000 at dam No. 3.

The interest on that investment of $50,000,000 would be, at 4 per cent, which Mr. Ford agreed to pay (on whatever amount the cost may be), $2,000,000. He has also a maintenance fund of $55,000 and an amortization fund of $46,547, making a total of $2,101,547. Now, if he is able to realize a 100 per cent load factor; that is to say, if he can use all the power all the time, the cost of that power, calculated only on those items, would be $17.36 per horsepower year. But no one can attain a 100 per cent load factor. If he can build up a load factor of 70 per cent; that is to say, use 70 per cent of the power, the cost of the power that he uses would be $24.80 per horsepower year. That is not specially cheap power. That is not the kind of power that would give cheap fertilizer.

The CHAIRMAN. You have considered nothing but primary power?

Mr. WALDO. Yes, sir; but secondary power is an entirely different matter and the statement has been made by the southeastern power companies that even the 10-month secondary power is without commercial value. I am not going to say that it is entirely without commercial value, but it must be supplemented in some practical way, and a large investment must be made to make it commercially useful.

The CHAIRMAN. I do not think it is seriously contended that it is all without commercial value and, on the other hand, it is not seriously contended that it all is of commercial value. Some of it is almost as valuable as primary power.

Mr. WALDO. If you can stabilize that power so that it is there during certain definite periods of the year, then you have a valuable secondary power; but if it is there one week and gone the next week, varying with the unregulated flow of the river, then, of course, it is not of value.

The rental cost of that primary power would then be about $4.80 more than the total cost of Niagara power at the Falls plants; but Mr. Ford must now add the operating cost of making the power, which would bring the total cost to something over $27 per horsepower-year. This is not cheap hydroelectric power. Even the steamplant will produce power at about $26 per horsepower-year with reasonably priced coal. So it all comes down to how much of the secondary power can be utilized, and in order to utilize his secondary power it must be made reliable; that is to say, he must be able to depend on it over a certain season of the year, and in order to accomplish that he would have to operate steam plants for one thing, which adds seriously to the power cost, and build these storage dams for another thing, which promises to be much more economical, and interconnect that power down there with other sources of power in the Southeastern States, which is another way, although at present a limited way of building up secondary power. Therefore there is the strongest business reason for Mr. Ford to do this thing. The cost of those dams, while not computed, is very obviously much less than he could afford to spend to double the

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amount of his primary power at Muscle Shoals; and, of course, the building of Muscle Shoals Dam No. 3 gives him just 38 feet more head over which to use the water which he conserves with those storage dams.

The CHAIRMAN. I have always felt, Mr. Waldo, that no private individual would bind himself to build these storage dams unless he intended to utilize and build enough dams on the river between the storage dams and Muscle Shoals so that he could get the benefit of his expenditure, and Mr. Ford has not agreed to do that. I do not believe he will do it, because it seems to me there is only one power in the world that can afford to do that, and that is the Government. It is true that if he should build a storage dam and somebody down below would build a dam for power purposes, under the water power act they would have to contribute their proportion.

Mr. WALDO. There is one dam already there, Senator, at Hales Bar.

The CHAIRMAN. Oh, yes; there is one; but there are places for a whole lot more. There is more power to be developed along the river.

Mr. WALDO. Oh, yes; certainly.

The CHAIRMAN. Private individuals can not be expected to go up and build reservoir dams; because they have to wait to get any return out of it for other people to develop power between them and Muscle Shoals. The Government could afford to do that, then everybody who built under the law any dam between would have to contribute to the Government part of the expense.

Mr. WALDO. I think Mr. Ford would be very glad if the Government would build those storage dams, Senator.

The CHAIRMAN. My idea of it is that the Government ought to do it, because you can not expect a private person to do it, because he may have to wait 25 years before somebody else develops more power, and men will not invest their money to do that. The Government can afford to do it, and as soon as the Government does do it it will be the greatest inducement for other people to come in and build power dams and take them under the water power act, because they will get a great deal better and cheaper power that way than they would if these dams are not constructed.

Mr. WALDO. However, Senator, Mr. Ford is interested, assuming that he has Muscle Shoals. The fact that he can get 140,000 additional primary horsepower by building these dams would make him rather impatient if the Government should lose time in going ahead with the proposition.

The CHAIRMAN. The Government is not going to do it if it accepts Ford's offer, of course, because it has no direct interest in it then. The Government, of course, will not build those dams then.

Another reason why it ought to be done is that it is fair to assume that this flowage right will cost more in the future than it will now. The country will settle up and land will become more valuable, and therefore the expense will be increased and may be increased to such an extent that it is not a practical thing to go ahead with. The Government itself could go ahead and do it all at once, even if it had to wait a while for a return on some of its money, and thereby bring about great development of the entire stream, and it would be a good thing to do, but I don't know how any private individual could be expected to do it. Nobody has offered to do it. Mr. Ford would not think of binding himself in his contract to do it. We could not expect him to. I myself would not expect him to do it, and I don't believe he ever would do it.

Mr. WALDO. Senator, he has the best kind of business reasons for doing it, and his chief engineer, Mr. Mayo, has testified that he is prepared to spend $50,000,000, if necessary, to carry out his end of this plan, and it requires only a fraction of $50,000,000 to build those dams.

The CHAIRMAN. I took his statement to mean that Mr. Ford would spend $50,000,000, including factories at Muscle Shoals, where that city is going to be built.

Mr. WALDO. Well, he had in mind these dams up here, Senator.

The CHAIRMAN. I don't think he had.

Mr. WALDO. Mr. Mayo has told me that he did have.

The CHAIRMAN. He did?

Mr. WALDO. Yes, sir.

The CHAIRMAN. Well, that is another thing. Can Mr. Ford speak for the corporation after he is dead—that it will do it?

Mr. WALDO. Well, sir, I expect that there are some elements of risk in the Ford offer, and one of them is that Mr. Ford may die right away; but if Mr. Ford lives, we will say, another 10 years, if you please——

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The CHAIRMAN. I think that is a fair assumption to say that he would live 10 years.

Mr. WALDO. All right, sir. Then under those conditions I think it would be a fair expectation that these improvements will be put in.

The CHAIRMAN. Well, Mr. Waldo, in 10 years; if this proposition were accepted to-day, it would be 10 years before the thing would be in full swing.

Mr. WALDO. I agree with you, as to the whole storage project.

The CHAIRMAN. If we accept Mr. Ford's offer to-day, it will be 10 years before the factories begin to operate in good shape and are well organized.

Mr. WALDO. Well, sir, I have seen something of the way they do things there at the Ford plant, and 10 years is a long time in the history of the Ford organization.

The CHAIRMAN. Yes; I admit that. I have great respect for him. I think he has built up a wonderful organization.

Senator HEFLIN. His friends say if he gets this proposition he will go down and go to work right off, and they will have them ready when the dam is completed, practically.

The CHAIRMAN. We figure on completing these two dams in about five years. You can put on paper figures that would indicate that it could be completed quicker, but the history of all these things is that ninety-nine times out of a hundred it takes longer than the figures would indicate. I do not mean by that to cast any reflection on any estimates, either, but that has been the history of all such things from the beginning of civilization, that it takes longer than we think it will.

Mr. WALDO. What little experience I have had with Government matters seems to point to the fact that the Government takes as long as anybody to do those things.

The CHAIRMAN. I am inclined to think it takes longer; but this can be said about the Government, with probably some few exceptions: That when the Government completes a job you could not improve it; it is as near perfect as human ingenuity can make it.

Mr. WALDO. I agree with you, Senator. They do good work when they do it.

The CHAIRMAN. Yes, sir; and if we are working for a hundred years, now—and that is what we are—and, incidentally it ought to be said that nobody knows whether this work will last a hundred years, because there has never been a dam like this constructed that has been in operation for a hundred years——

Mr. WALDO. If you will pardon me, Senator, there are a great many dams of less permanent construction than this that have been in operation for more than a hundred years.

The CHAIRMAN. That is going to be the biggest dam of concrete that man has ever put up in the world, and there is going to be more water go over Dam No. 2 than ever went over any other dam.

Mr. WALDO. It might be expected to have a longer useful life than some smaller structure.

The CHAIRMAN. No; it would be the other way, I think. I am not pessimistic about it. I am not afraid to take the risk, but there is a risk in it, and I do not believe anybody can doubt that. It may be that a hundred years from now invention may have advanced so that this dam will be useless, will not be worth anything.

Mr. WALDO. But, Mr. Ford would have to go right along paying his 4 per cent.

The CHAIRMAN. He will make enough millions out of it in five years after he gets it, so that he can pay that all off in cash.

Mr. WALDO. I am not going to say that I know anything about Mr. Ford's ideas in the matter, but from conversations he has not indicated that he is going into this thing to make the last possible dollar out of it.

The CHAIRMAN. I know, and I do not mean to charge that either, Mr. Waldo. I am not charging him with any motive like that. If you could insure me that he would live a hundred years, I would look at this proposition in an entirely different light than I do.

Mr. WALDO. I do not ask you to go beyond the contract itself, Senator.

The CHAIRMAN. Well, now, speaking of the contract, there has not been much said about it in this examination, but I have been thinking and looking it over on Sunday instead of going to church, and find that this $55,000 you

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have been speaking of that he pays to the Government, as maintenance of these two dams in my judgment will not be one-tenth of what the Government will have to pay to keep those dams in repair. Under Ford's offer the Government guarantees it will keep both of those dams in repair for 100 years, and the only contribution made toward that is $35,000 annually for Dam No. 2, and $20,000 for Dam No. 3 by Mr. Ford.

Mr. WALDO. You think it will run $200,000 to $300,000 a year?

The CHAIRMAN. Yes.

Mr. WALDO. On what do you base that, Senator?

The CHAIRMAN. I have talked with engineers about it, and just my knowledge of everything human, and the fact that this guaranty is going to run for 100 years, that it is almost the same as perpetual. If you buy land in a city, or if you get a lease for 100 years, you consider you are the owner of the land. Suppose an accident should happen down there and it would take $100,000 to take care of the dam in a year. The Government has to pay it. The Government not only has to pay it, but the Government has to do it. These people who are opposing Government ownership and operation so strongly and who are in favor of the Ford proposition, forget that the Ford deal itself provides not that Ford will keep the dam in repair, but that the Government shall do it. It must actually do the work and keep it in repair for Mr. Ford, and Ford pays them an insurance, like you would take an insurance policy of $35,000 on one dam and $20,000 on the other.

I think experts will say—and they have nothing to base it on, running over a hundred years—but experts I think will tell you that you could not go anywhere in the world and get any company, any corporation, or any individual that would write a guaranty to keep these dams in repair for that amount of money. The Government, even under the Ford offer, will have to keep a set of men there and will actually keep them there all the time. That is what they will undoubtedly do. If they owned it themselves they would have to do it, but they will have to do that whether they lease it to Ford or the Government operates it. There will be no difference, so far as maintenance and work on the dams is concerned.

Mr. WALDO. Don't you think, Senator, that a good way to find out what that should probably amount to would be to consider similar cases that have already been in existence for a period of years?

The CHAIRMAN. I have written letters, now, to get that very information. If I am disappointed I will certainly be glad, and I will submit the evidence no matter whether it carries out what I feel it will or whether it shows that Ford is right. I would be glad to have it show that this is enough money to do it.

Mr. WALDO. And if we can develop certain other evidence in connection with that to show the permanence of such a structure, may we put that in the record?

Partial list of old masonry dams, compiled from Wegman's "Design and Construction of Dams."

DAMS MORE THAN 100 YEARS OLD.

Year completed.	Name.	River.	Location.	Greatest height.	Remarks.
Prior to 1586	Almanza		Spain	68	Rubble masonry faced with cut stone.
1594	Alicante	Monegre	do	134	Do.
1791	Val de Infierno.	Luchena	do	116	
1782	Lampy	Canal of the South.	France	51	
1800	Meer Allum		India	39	Masonry arches.
About 1780	El Molino		California	15	

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Partial list of old masonry dams, compiled from Wegman's "Design and Construction of Dams"—Continued.

DAMS MORE THAN 50 YEARS OLD.

Year completed.	Name.	River.	Location.	Greatest height.	Remarks.
1866	Cagliari	Corrongius	Sardinia	70	Rubble masonry in lime mortar.
1843	Zola		France	120	Rubble masonry.
1866	Furens	Furens	do	184	Do.
1870	Ban		do	151	Do.
1870	Verdon	Verdon	do	59	Rubble masonry on concrete base.
1870 [1]	Gileppe	Gileppe	Belgium	154	Rubble masonry.
1869	Tielat	Tielat	Algiers	70	
1868–1870	Poona	Mitha	India	127	Uncoursed rubble reinforced with 30-foot earth bank (length, 5,136 feet).
1870 [1]	Tansa	Ganges	do	118	Uncoursed rubble (length, 8,800 feet).
1871 [2]	Bhatgur	Yeluand	do	130	Masonry (length, 4,037 feet).

[1] Date started.
[2] Final plans approved.

NOTE.—Each of these dams is either in actual service or is in serviceable condition. (According to Wegmann).) Special attention should be called to a dam started shortly after 1873, when the final plans were approved, known as the Betwa Dam on the Betwa River, in India, a 60-foot dam built of rubble masonry laid in hydraulic lime mortar. The dam is 3,296 feet long. Its entire length is used as a spillway, for the river flow varies from 50 to 750,000 cubic feet per second, and this dam has been in actual service for more than 30 years.

DEPARTMENT OF THE INTERIOR,
UNITED STATES RECLAMATION SERVICE,
OFFICE OF THE DIRECTOR,
Washington, July 7, 1922.

Mr. W. G. WALDO,
205 Third Street SE., Washington, D. C.

MY DEAR MR. WALDO: In answer to your oral inquiries I referred to a letter from Director Davis to Maj. J. H. Burns, dated June 14, 1922, and as requested, I am handing you a copy of that letter.

I am also giving you a copy of the latest (twentieth) annual report of the Reclamation Service, from which data can be collected as suggested in the letter to Major Burns.

Hoping these will meet your needs, I am,
Very truly yours,

J. B. BEADLE,
Director's Assistant.

JUNE 14, 1922.

Maj. J. H. BURNS,
3747 Munitions Building, Washington, D. C.

MY DEAR MAJOR BURNS: Answering oral inquiries respecting the depreciation or maintenance cost on masonry dams, our experience has been that such cost is very low, probably so low that insufficient time has elapsed to permit any general conclusions from the structures of the Reclamation Service. Also the conditions affecting the different structures vary so that it is dangerous to draw conclusions as a guide for prediction elsewhere.

However, I am sending you herewith a copy of the latest (twentieth) annual report, in which will be found some information along this line. For example, in the case of the East Park Dam there was charged to maintenance account $185 for the calendar year 1920 (p. 105). This structure, with related spillway and dikes, cost about $154,000; the whole storage unit, involving in addition to the dam a feed canal and other items, cost somewhat over $450,000 (p. 104). The dam is a concrete arch, gravity type, with a maximum height of 139 feet, crest length of 250 feet, and volume of 12,200 cubic yards (p. 538). It was completed in July, 1910 (p. 100). From that time to December 31, 1920, the maintenance account for the dam was charged with a total of $8,015 (p. 105).

Similar data respecting other dams of the Reclamation Service can be found in the same way throughout the report. In some cases the data are not given separately for the dam but show only the totals for the reservoir and in a few

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cases there may be shown only the total figures for the project-storage system, which may include more than one reservoir.

From these figures and from actual knowledge, I know that the maintenance costs on the dams themselves have been exceedingly low. Probably the bulk of the costs given in the report after the fashion above indicated do not represent any work on main structures but include repairs and replacement of operating mechanisms and such things which are related to the dams and which are much more subject to depreciation.

In a few cases there have been substantial expenditures connected with the dams of the Reclamation Service some time after their construction, and it may be that these are charged to the maintenance account because they are technically classified that way in the eyes of the law governing us, and the charges we must collect from the irrigators who benefit from the works. However, in these cases that I have in mind the substantial repairs or other work were due either to the repairing of damage by flood or to the completion of some work that was deliberately postponed when the dams themselves were first built. In the first category there were some substantial repairs to the spillway at the Roosevelt Dam on the Salt River, Ariz. In recent years a flood came with the reservoir full and put a considerable depth of water over the spillway. This eroded the spillway channels to an extent that made it seem wise to concrete them in anticipation of future floods. This might be called repair, but is more accurately described as betterment, being simply additional work over that originally contemplated and carried out rather than repair or replacement of something that had been built and worn out.

In the other category falls another case of spillway improvement at the Elephant Butte Dam. Here it was always contemplated that substantial work would be required on the spillway additional to what was done when the dam was built, but the work was postponed to spare the expenditure until necessary as well as to permit the selection of a time for it that would be more advantageous and economical. It was clear that the work was not needed at first because the reservoir was designed for large holdover capacity and took a number of years to fill.

From such figures as I have I think the depreciation or maintenance on the body of a well constructed masonry dam will usually be a small fraction of 1 per cent of its cost annually.

Very truly yours,

A. P. DAVIS, *Director.*

Maintenance cost of concrete or masonry dams, U. S. Reclamation Service.

Project.	Dam.	Type.	Maximum height (feet).	Crest length (feet).	Volume (cubic yards).	Year completed.	Maintenance cost.		
							Total to Dec. 30, 1920.	Approximate average per year.	For calendar year 1920.
Orland, Calif.	East Park	Concrete	139	250	12,200	1910	$8,015	$783	$185
Yuma, Ariz.	Laguna	Concrete and rock fill weir.	10	4,780	441,732	1909	43,681	3,640	1,300
Boise, Idaho	Arrowrock	Rock fill, concrete core.	349	1,100	585,130	1915	[1] 4,766	950	[1] 567
Minidoka, Idaho	Minidoka	do	86	937	242,500	1906	20,737	1,480	863
North Platte, Nebr.-Wyo.	Pathfinder	Broken range masonry arch.	218	432	60,210	1909	12,320	1,070	1,304
Do	Whalen	Concrete	29	300	80,740	1909	1,179	100	
Shoshone, Wash.	Shoshone	Rubble concrete arch.	328	200	78,576	1910	12,115	1,100	101

[1] Includes maintenance on 3 earth-fill dams also used for storage.

NOTE.—The low annual cost for maintaining concrete or masonry dams is indicated from the above records of the Reclamation Service which represent a few cases in which data are available in the twentieth annual report of the director. Unfortunately this specific information is not published for the greater part of the reclamation structures. As pointed out by Mr. Davis in the above letter, the period covered by the data is too short to use as a basis for general conclusions, and special conditions at a given dam may lead to expenditures of a wholly different order than those indicated above. The foregoing exhibits are offered merely to indicate the permanent nature of concrete and masonry structures, their long life and probable low maintenance cost. Maintenance of crest gates would undoubtedly be the chief item in the maintenance of Dam No. 2, Muscle Shoals, outside of the power house.

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The CHAIRMAN. Yes, sir. I will be very glad to have it. You will not be able to say when we get through with this hearing, Mr. Waldo, that I have kept out any evidence that I feared would contradict my own statements.

Mr. WALDO. We have no such idea, Senator. A great concrete dam is probably as nearly a truly permanent structure as can be built by man. The maintenance cost is very small. Since cheap power comes down to a proposition of utilizing the secondary power, one might conclude that this could be readily done by selling this secondary power to factories already established in that section having their own steam-power plants. It is true that at a considerable distance from Muscle Shoals there are a good many industrial plants that are operated by steam power, and if you had reliable secondary power you might be able to sell some very cheap power to those companies and let them shut down their steam plants; but no one is going to shut down his plant unless he knows he is going to have the hydroelectric power for a definite length of time. He can not afford to disrupt his organization for the sake of saving a few mills per kilowatt hour for a while. So that as long as your power is of reasonably stable character you could dispose of it, but otherwise you could not even supply it to those companies. They would not have it as a gift. It would be a liability instead of an asset to them.

In this connection the power companies that were invited to bid on Muscle Shoals at the time that Mr. Ford was invited, and who with one accord declared that the secondary power was of no commercial value, made a statement about the secondary power that I would like to put into the record.

The CHAIRMAN. What is it?

Mr. WALDO. It is a combined statement signed by the four principal power companies of the Southeast.

The CHAIRMAN. I would be glad to have you put it in the record. Do they say this secondary power is of no account?

Mr. WALDO. Yes, sir. They say that the secondary 10 months' power has no commercial value.

The CHAIRMAN. Ten month's power?

Mr. WALDO. Yes, Senator; and that we consider to be the very cream of the secondary power.

The CHAIRMAN. Are those people interested in Muscle Shoals? Are they interested in its purchase?

Mr. WALDO. They were merely invited to bid, as Mr. Ford was invited to bid. Here is their statement. It is taken from the hearings of the House committee, and was put into the record by General Beach [reading]:

"The 10 months' secondary power which it is possible to produce at Muscle Shoals has little or no commercial value.

"There are 9 years during the 26-year period covered by the hydrograph of the Tennessee River at Florence, Ala., during which the total availability of primary power on 100 per cent load factor was less than 700,000,000 kilowatt hours per annum. To supply such deficiencies—which will undoubtedly occur periodically in the future as they have in the past—stem backing equal to the full capacity of the Sheffield steam plant, i. e., 60,000 kilowatts, must be exclusively available subject to call to meet such deficiencies; in certain years that capacity would not have been sufficient." (Hearings before House Committee on Military Affairs on Muscle Shoals proposition, Sixty-seventh Congress, second session, page 118.)

The CHAIRMAN. I suppose when they speak of the full capacity of the Sheffield plant they mean the steam plant at nitrate plant No. 2?

Mr. WALDO. Yes, sir. Then they go on to say that [reading]—

"The hydrograph of the Tennessee River at Florence, Ala., for 26 years (from 1894 to 1919, both inclusive) shows frequent periods of time varying from portions of a month to an entire month, to several entire months, up to a year, when there is no 10-month secondary power. There are only 3 years during the period of 26 years during which such periods or gaps do not occur. There are 7 years in the 26-year period observed during which there is either no 10-month secondary power at all or only a negligible amount. The gaps in the 10 months secondary power, together with the impossibility of predicting when they will occur, inevitably lead to the conclusion that the 10 months' secondary power has no commercial value for public service use capable of measurement."

Our answer to that is that we agree with them absolutely; that if you stand on this thing as it is to-day it is tremendously overestimated by the people

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who now claim that Mr. Ford is getting a wonderful bonanza, and we say that he is getting a good thing only if he spends a large amount of money, Senator.

The CHAIRMAN. Yes; but who signed that statement? What are their names? They were contemplating bidding, were they not, like a fellow when he wants to buy a horse; he runs it down just as much as he can. That is what they were doing then.

Mr. WALDO. Let us discount it to the fullest degree on that score—the engineering facts, however, are just as they stated.

The CHAIRMAN. I am not an expert, but when any man tells me that he can operate water power for 10 months in the year and it has not got any value because it will not operate that way every year, I think I have intelligence enough to know that he is trying to hoodoo me.

Mr. WALDO. But their claim is perfectly sound under nonregulated conditions, Senator. They say that it is without value "for public-service use"—that is quite different from electrochemical use.

The CHAIRMAN. Of course, it is not like primary power; but if we have a water power that is good for 10 months you can afford to build a steam plant to run for the other two.

Mr. WALDO. Exactly, if it is 10 months every year, or reasonably close to 10 months every year.

The signatures on that statement are Georgia Railway & Power Co., by H. M. Atkinson, chairman, board of directors; Columbus Power Co., by H. H. Hunt, vice president; Central of Georgia Power Co., by P. G. Gossler, vice president; Tennessee Power Co., by C. M. Clark, president. It is dated May 20, 1921.

The CHAIRMAN. My own personal opinion is that if we pass some bill providing for a governmental corporation to operate this plant the thing to do would be to operate the nitrate plant No. 2 on secondary power and sell the primary power.

Mr. WALDO. As far as possible. Of course, you would have to have some primary power to operate that nitrate plant.

The CHAIRMAN. Oh, yes; you would have to have some primary power, but you could safely sell practically all the primary power that you develop there and then take the secondary power and back it up with the steam. It would cost you a little more money for power, but you would make enough money out of the power that you sold to make a profit out of the whole proposition. Besides, it may be that experience will show that if we operate this plant 10 months in the year it may be enough, even if we hold an organization and give them a vacation of 60 days instead of 30.

Mr. WALDO. You have to consider that you are obliged to supply the full capacity of the nitrate plant in nitrogen fertilizers prepared according to demand; in other words, as a mixed fertilizer, which calls for phosphoric acid. If we consider the normal, present-day status of things it means four times as much phosphoric acid as nitrogen, and if you are going to use the most improved methods, which Mr. Ford here agrees to do, that means electric furnace phosphoric acid and that means the consumption of another hundred thousand horspower in order to supply sufficient power to make enough phosphoric acid to balance that nitrogen that he is compelled to put in. We will assume that he buys his potash; we will say he gets it from abroad more cheaply than he can produce it; but if he goes into the potash end of the thing there is no telling how much power he will be required to put into fertilizer manufacture.

The CHAIRMAN. He will not go into that until he has surplus power.

Mr. WALDO. And not until it has worked out to a greater extent than it is now.

The CHAIRMAN. You could not expect him to do that, and he would not try. That is just a possibility. If things are favorable, it will come about, and if they are not favorable it never will be realized.

Mr. WALDO. A 2–8–2 fertilizer means 40,000 tons of nitrogen (equal to 250,000 tons of Chilean nitrate, which is the entire amount used in American agriculture in such a normal year as 1913), 160,000 tons of phosphoric acid and 40,000 tons of potash. That is the plant food content of about 2,000,000 tons of 2–8–2 fertilizer, and that is somewhere between 25 per cent and 30 per cent of the total fertilizers consumed in the United States, which, it seems to me, is undertaking a very large-sized contract, Senator. A man who is willing to get under such an obligation as that, I should say, is entitled to in considerations in the matter of power, getting it, for instance, at an in-

terest rate of 4 per cent, even without considering his obligations regarding the nitrate plant. Suppose a new process comes along. To-day it is the cyanamide process. To-morrow it may be something else.

The CHAIRMAN. We all hope that will happen.

Mr. WALDO. Then what would happen. Under his contract he is obliged to adopt such improved methods.

The CHAIRMAN. Would he not, if he was not bound to do it? If you could make a fertilizer at a reduced cost, and you would be bound to make a certain quantity, would you not utilize that method?

Mr. WALDO. That would not mean anything to him personally if he could make only 8 per cent. The higher the cost the more money he could make.

The CHAIRMAN. Unless there is some improvement he will not make 8 per cent on the operation of the nitrate plant, and he does not expect to.

Mr. WALDO. I agree with you, Senator.

The CHAIRMAN. So if he can devise a new plan, as I think is going to be devised, it seems to me, since there are thousands of scientific men all over the world working on it. Of course he will utilize it. If he considered only his own interest he would utilize it. This corporation, after he is dead, would do that.

Mr. WALDO. Assuming, then, that he does keep up, it is very likely, based on what we are discussing here, that he will have to rebuild that plant not once, but probably several times in the course of its ordinary life.

The CHAIRMAN. It may be.

Mr. WALDO. Suppose the Government had that plant. Would they be likely to do the same thing?

The CHAIRMAN. The bill that I have introduced provides that they shall more than Ford's proposition, because Ford is going to scrap plant No. 1, and all the scientific men who have appeared before us agree that the Haber process in plant No. 1 offers the greatest promise of improvement, and the cheapening of the product. The bill that I have introduced provides that we shall put plant No. 1 in operation and have our experiments going on all the time. Ford is going to use that to make automobiles or something else.

Mr. WALDO. But, Senator, although he has not obligated himself to operate nitrate plant No. 1 as an air nitrogen fixation plant, still he has not agreed not to operate the Haber process, which is an entirely different thing.

The CHAIRMAN. Oh, no. Of course, he can use any process he wants to, and if, by experimentation, either by them or outside parties, some other process is invented (it may be known as the Waldo process) they will want to use it if it is the best, and we want to be in shape so that whoever has it can do that.

Mr. WALDO. But the idea that nitrate plant No. 1 represents an asset in this case is not in accordance with his ideas, as I understand them. It is not that he necessarily thinks that nitrate plant No. 1 represents a process that is wholly impracticable and could not be used at all, but it is simply that the physical conditions existing in No. 1 plant are such that he does not want to be obligated to spend the money necessary to put it in at that particular point. That is all.

Further, after all, Senator, when you consider the sources of nitrogen fertilizers in the United States, those who can produce them at the least cost and whose supply can be sold so as to be consumed first, are the by-product coke ovens. They are in the best position to beat competition. They do not, but they could do it if they wanted to, because their coats are a matter of bookkeeping. It is a by-product with them. After that there are the air nitrogen fixation processes that are available, and finally the country resorts to importations. If you can spread the cost of your fertilizers over some other useful product, is not that an effective way to go adout reducing the cost of fertilizers?

The CHAIRMAN. Well, that is one way, and a very good way, I should think.

Mr. WALDO. That is one way that he has in mind. The testimony shows efforts to bind him to make nothing but fertilizers here, but if you tie him hand and foot in this regard, then the result is unfavorable because of the fact that he may not be able to do as well for agriculture under those conditions as he might with less restriction.

The CHAIRMAN. He is not bound to follow any process. He can use any process he wants to.

Mr. WALDO. Certainly, but he should not be compelled to make fertilizers exclusively there.

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The CHAIRMAN. And I suppose he will use the best and the cheapest. That would be to his own interest, as well as to the interest of the country.

Mr. WALDO. The only reason for bringing up that point is that the contract does not say just how much power he shall devote to this proposition, because, as we figure, it would not be an advantage to do so; it would be a disadvantage.

The CHAIRMAN. I am not asking that it should, Mr. Waldo. I am not criticizing his offer in that respect.

Mr. WALDO. I understand, Senator. I am simply pointing out these various things for the sake of having a clear understanding about them.

The CHAIRMAN. For instance, our experts tell us that the Haber process is the promising one. They may be disappointed. They may be deceived. But they expect that the improved method of extraction of nitrogen from the air will be by the improved methods of the Haber process rather than the cyanamide process. It means that that eliminates the power to a great etxent, because the Haber process does not require as much power as the cyanamide process does, and improved methods may be such that power will be so small an item that it will be completely eliminated. We do not know, but the tendency is toward a less amount of power to produce nitrogen.

Mr. WALDO. And, of course, that means cheaper and cheaper fertilizer.

The CHAIRMAN. All the time. Certainly it does; and it is the hope, I think, of everybody who is earnest in it at all to keep on improving the process, but they may be disappointed. It may occur that some bright Yankee will come along and revolutionize the cyanamide process by which it will come into favor again. We do not want to put ourselves nor any bidder down there in such condition that you are tied up to any particular process by any means.

Mr. WALDO. By no means.

The CHAIRMAN. But if I were putting in the money and were going to consider it, I would consider that the Haber process, because the men who have studied it all their lives tell me that is the promising process, would be the one to use.

Mr. WALDO. Here is the report on nitrogen fixation and utilization of nitrogen, a splendid piece of work prepared by the Nitrate Division of the Ordnance Office of the War Department. In view of the possibilities that are set up in that document any fertilizer contract that would tie down Mr. Ford to a definite line of procedure, a definite amount of power, a definite product for his fertilizer, would not be an asset but a liability from the standpoint of getting the most out of this plant for the country at large.

The CHAIRMAN. I agree with you, Mr. Waldo. Nobody wants to tie him down to a definite amount of power, but there are two reasons why we get into difficulty there, and the first and most important of all is that that can not be controlled by Mr. Ford or anybody else. We all expect to improve the method. Nobody knows how it is going to be done. Everybody is trying to do it, and in a hundred years' time the fertilizer question, or even 50 years from now, may be the least of all the farmers' problems. There may be some other method developed to get fertilizer by which we will not want to make it down there at all, and that is one reason why I think the Government ought to keep it. If that time comes, we can stop making it. We do not want to make a contract with somebody else and let him decide whether he should do this or do that because of the uncertainty of the future. It is a physical impossibility I admit to make a contract with anybody that would be satisfactory to either side because of the uncertainties of the future.

Mr. WALDO. Of course it is always a difficult thing to make a contract that will satisfy all interests concerned, Senator.

The CHAIRMAN. I think you are right, and I think it is not only difficult, but after all, when we get right down and are honest with ourselves, we have got to admit that it is an impossibility, and so I don't like to try it. We don't know what the future has in store.

Senator HEFLIN. What are we going to do with it? Just let it stay there?

The CHAIRMAN. No, no, no. I am just as anxious to go ahead as any of you fellows are, but it seems to me that we ought to keep it at all times right in the hands of the Government so we can take advantage of anything that comes along. Now, we have got to maintain plant No. 2 there as a war proposition. We will not dare to scrap it. We never will scrap it until we get something better, and when we get something better then we ought to scrap it at once and not hesitate at all.

Mr. WALDO. With regard to Government operation of things, I want to mention just one case of personal experience if I may.

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You have here the greatest printing plant in the world. The information in those documents is probably equal to that in all our American textbooks combined. Yet we have down at Chattanooga public library a large collection of those documents, and I doubt if there are 20 people in the city of Chattanooga that know that those documents even exist.

The CHAIRMAN. Do you offer that as an argument against the Government operation of the printing plant?

Mr. WALDO. No, sir; not at all; but I simply offer that as an indication of Government methods in comparison with those of private individuals.

The CHAIRMAN. Suppose the private individual made the same documents. Would anybody read them more than they do now, because the Government makes them? Do you read this pamphlet or do you throw it aside because the Government prints it, and would you read it if I printed it and charged a little more for it?

Mr. WALDO. If it were brought to the attention of the people who are interested in those subjects it would have a much larger circulation and become useful instead of lying for years at a time on some library shelf unknown and unnoticed.

The CHAIRMAN. I agree with you absolutely, but that is no reason why the Government should stop operating the Printing Office.

Mr. WALDO. Not at all; but it illustrates a lack of businesslike methods in the distribution of a mighty good product.

The CHAIRMAN. That has no tendency to prove that the operation of the Government Printing Office is more expensive than though it was done by a private party.

Mr. WALDO. It shows lack of ordinary business interest in commercial transactions. They have a wonderful product but most people know mighty little about it.

The CHAIRMAN. The Government Printing Office is not a selling organization. The Government operation of the Printing Office has nothing to do with the sale side of it.

Mr. WALDO. But what is the purpose of the Priting Office if it is not to disseminate information?

The CHAIRMAN. It is to give an opportunity to anybody to read its publications or to get them at cost. If the people do not want them, or if they were printing a lot of stuff that is not readable or that the people do not read, that I do not see is any reason why the Government should stop running the Government Printing Office.

Mr. WALDO. I don't either, and I do not argue that at all, but I simply point to that as an instance where Government operation has resulted in utter lack of appreciation of what the Government is doing.

The CHAIRMAN. I think you are right.

Mr. WALDO. If you want to buy a publication right here in town, just consider the difficulty of doing that. For instance, if you want to get half a dozen certain different maps you will have to go to as many different places, widely separated.

NOTE.—Where Government maps and charts are obtainable:

Map or chart of—	Obtainable from—
Atlantic, Gulf and Pacific coasts	Coast and Geodetic Survey, New Jersey Avenue and B Street SE., Washington, D. C.
City of Washington	Do.
San Francisco peninsula	Do.
United States in outline	Do.
Alaska in outline	Do.
Birthplace of Washington	Do.
District of Columbia	Do.
Bahama Islands	Do.
Ohio and Wabash Rivers	United States Engineer's Office, room 425, Custom House, Louisville, Ky.
Great Lakes	Lake Survey, Old Custom House, Detroit, Mich.
Lake Champlain	Do.
St. Lawrence River down to Cornwall, Canada.	Do.
Mississippi River from the Head of Passes to headwaters.	Mississippi River Commission, 1311 International Life Building, St. Louis, Mo.
United States in whole and in part showing topographical and geologic features (such as are available).	Geological Survey, Department of Interior Building, Eighteenth and F Streets NW., Washington, D. C.

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Map or chart of—	Obtainable from—
States and Territories showing postal routes.	Topographer of the Post Office Department, Post Office Building, North Capitol Street and Massachusetts Avenue, Washington, D. C.
States and Territories (general).....	General Land Office, Department of Interior Building, Eighteenth and F Streets NW., Washington, D. C.
National forests and forested regions....	Forest Service, Department of Agriculture, 930 F Street NW., Washington, D. C.

The CHAIRMAN. Yes. The Government does not issue them.

Mr. WALDO. The Government bureaus do, and each bureau does it in its own way.

The CHAIRMAN. What has that got to do with the Government Printing Office?

Mr. WALDO. That is just simply another example of the Government undertaking to meet a need that is ordinarily met by private individuals, private initiative. One part of good service, the production part, is wonderfully well done; the other requirements for putting the product into the hands of the consumer are woefully lacking.

The CHAIRMAN. Why do not private individuals print these maps that you say are difficult to get?

Mr. WALDO. Because they are part of the recorded data in large Government undertakings. Private interests in general do not undertake to compete with the Government in these maps.

The CHAIRMAN. Nobody takes them from the Government. That is no competition. People do not like to read them when the Government makes them.

Mr. WALDO. The things that they deal with frequently are not those things for which there is a large and universal demand, although that is not always true, by any means.

The CHAIRMAN. What would you have to pay for this document [indicating] if you went to the Government Printing Office and bought it?

Mr. WALDO. Fifty cents, and it is undoubtedly worth $5 to many people.

Major BURNS. The Government sends a copy of that document to everybody that it knows of that is interested in the subject.

The CHAIRMAN. Of course, it is something that the great mass of the people take no interest in. It is a scientific proposition. I have been amazed lots of times when I hear scientific men talking about a subject in regard to their knowledge about these Government propositions. In your own testimony to-day you have illustrated it. You know all about those reports. I don't know them. I haven't read most of those reports that you have referred to on the Tennessee River. But do you suppose you could take those reports to the State of Nebraska, for instance, and sell them for 5 cents apiece? There would be a few people, I suppose, interested in the subject who would buy them, but the ordinary person would not buy them.

Mr. WALDO. But many of these books are most excellent textbooks on their subjects; others are splendid for general reading.

The CHAIRMAN. Yes; they are.

Mr. WALDO. Yet frequently they do not get anywhere, Senator.

The CHAIRMAN. I agree with you.

Mr. WALDO. There are certain principles that we are trying to have incorporated into water-power development in connection with this particular Tennessee Valley development, and one of those is that the man who is willing to underwrite the future production of fertilizers to the extent of 25 per cent to 30 per cent of the fertilizers used in this country is entitled to receive a lower rate for power, and that means 4 per cent money. We claim that practically all power in the streams of the United States is paying an unwarrantable tax because of high interest rates. There is no other industry in which interest enters into the cost to such a great extent as in the development of hydroelectric power. It does not cost you a great deal of money to operate a hydroelectric plant, but it does cost a very large sum to build it.

So if you have to pay 7 per cent or 8 per cent for your money, your interest charges constitute most of your power cost. If your power costs you $200 per installed horsepower, your interest at 8 per cent, and your fixed charges will total as much as 85 per cent of the cost of the power. In what other industry do the fixed charges amount to such a large percentage of the total

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cost? We are unable to find any other, and we think that as a general policy on navigable streams, if it were possible to do so, the interest rates ought to be brought considerably lower than they are. Whether it is practical to reduce rates is another matter. Whether the Government could build powers on navigable streams with 4 per cent money, and thereby benefit a large number of people by cutting the cost of electric power in half, is certainly a physical possibility; whether it would be advisable as a matter of public policy is something else. What we hope to do by means of this survey is to be able to reduce the uncertainties in connection with this navigation-power development so that the man who puts his money into it will say, "You are asking me to take such risks in connection with this thing that I am going to have to have a higher interest rate."

The CHAIRMAN. Mr. Waldo, I think one of the reasons, and I believe you will agree with me in saying it, and perhaps the main reason that the installation of hydroelectric power costs so much and why people are afraid to put their money into it, afraid to furnish the money to do it and finance the operation, is the risk that is always involved in a water-power proposition that it may be destroyed by flood overnight.

Mr. WALDO. Possibly, Senator. How shall we reduce that risk? By getting the facts through such a survey as is proposed. But more power projects have failed for lack of water than because of too much water, Senator.

The CHAIRMAN. That is the reason, I think, why you have to pay high interest when you go into a proposition and borrow the money.

Mr. WALDO. Yes, Senator, because of risks, most of which are due to lack of sufficient reliable data to serve as a basis.

The CHAIRMAN. Mr. Ford avoids that in this case by having the Government guarantee the maintenance of his two dams by paying them $55,000 a year as an insurance bond.

Mr. WALDO. Only as to the most permanent parts of the structure. He maintains the power houses and their equipment himself, Senator.

The CHAIRMAN. He does not run that risk in his proposition that the ordinary person runs of being wiped out overnight, hence the fellow loaning the money on it would not be so afraid as if he did not have the Government guarantee to maintain his dams.

Mr. WALDO. And, then, he turns around and on his part guarantees for 100 years the maintenance of the power houses and their equipment and of this nitrate plant up right through to the stage of production of ammonium nitrate.

The CHAIRMAN. Yes; he could operate the nitrate plant No. 2 with this big operation, and take the product and give it away and have a fortune besides.

Mr. WALDO. Not unless he spends a large amount for improvements.

The CHAIRMAN. He would not need to spend anything. If he went ahead with his proposition, he would not need to build a building. He could sell all the power that he did not need to operate plant No. 2, and sell the real estate, building lots, and houses and things that he gets a deed of from the Government. This corporation could use enough power to run nitrate plant No. 2, according to his contract, his bid, and dump the result in the sewer and not get a penny for it and make millions out of the operation.

Mr. WALDO. I think you are mistaken with regard to the amount that he could make under the circumstances.

The CHAIRMAN. In the first place, he gets nearly 5,000 acres of land, improved, a town. He really has a city turned over to him with streets——

Mr. WALDO. With a string attached.

The CHAIRMAN. Yes; and I am going to speak of the string—with the streets, with the houses, even furnished with furniture, electricity, sewer, waterworks, heating plants in the houses. All that he gets a deed in fee simple for, and he can sell the next day. He can lay out the balance of the land that he gets in lots and sell them, and he can put them on the market now, or right after he got this, and he could make millions out of that one thing alone if he wanted to, and he would not violate his contract if he did it.

Mr. WALDO. The testimony, though, Senator, is to the contrary, that he could not sell a thing having to do with the nitrate plants that would interfere with the possibility of getting the results.

The CHAIRMAN. He can sell everything. His only obligation is to operate nitrate plant No. 2. He can sell everything else, and he can sell that, too, if it be coupled with the proposition. He can sell the whole thing out the next day, if he wants to. He has got an offer now, or the Government has, to take $2,500,000 for the Gorgas plant. He could sell every bit of power he develops to a company right there ready to buy right now.

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Mr. WALDO. I don't agree with that, Senator, but I don't want to get into a discussion with you.

The CHAIRMAN. I am not saying, Mr. Waldo, that he would. I am speaking now in the cold terms of his contract.

Mr. WALDO. But I claim that he not only would not, but could not.

The CHAIRMAN. You must admit that he could. I am willing to concede to you that Mr. Ford would not.

Mr. WALDO. I mean under his contract.

The CHAIRMAN. Under his contract he has a perfect right to do that.

Senator HEFLIN. Why do you say he could not, Mr. Waldo?

Mr. WALDO. Because the opinion as expressed by the Judge Advocate General before the House committee was that if under this contract he wanted to part with any of the lands or properties of Nitrate Plant No. 2 that were a part of the project, then he would be obliged to sell those properties subject to this provision. If there are buyers for this property subject to this fertilizer provision, they have not been in evidence thus far.

The CHAIRMAN. No lawyer will say that. No lawyer will ever put that interpretation on it.

Mr. WALDO. If he sells it all off, how is he going to continue his end of the operation, Senator?

The CHAIRMAN. All right. How is he? That is not for me to determine.

Senator HEFLIN. He would have to live up to the contract.

The CHAIRMAN. All right. Suppose he sells it and does not do anything with his contract, and shuts down the plant No. 2. What is going to be done? You can go to the extent of anything you can get out of this corporation, or the Government can, of course, but they have conveyed title to the houses and real estate, all except nitrate plant No. 2.

Mr. WALDO. Subject also to the contract, Senator. In so many words, it says so in the contract.

The CHAIRMAN. No; there is not anything of that kind in the contract.

Senator HEFLIN. Read that part of it.

Mr. WALDO. Section 13 says:

"* * * and deeds of conveyance to be delivered when full payment for said property has been made. Each of said deeds shall refer to or contain the provisions of this offer, and said deeds shall be so drawn as to make such provisions covenants running with the land."

With those covenants running with the land, who is going to buy land subject to this covenant by which you are obligated to operate this thing for a hundred years? If you will agree that such a purchaser will be found, then I will agree with you, Senator.

The CHAIRMAN. What covenant do you have reference to now?

Mr. WALDO. The obligation to maintain this plant for a hundred years and to operate it continuously in the manufacture of fertilizer at 8 per cent profit.

The CHAIRMAN. Well, perhaps, as I said before, as to nitrate plant No. 2, that he agrees to operate, he could not sell it to anybody else without violating that contract and the Government get in possession of it.

Mr. WALDO. Suppose you sell the houses and as the result you are not able to operate your plant.

The CHAIRMAN. That would not be the result. It does not follow that because he sells some of this real estate he could not operate the plant. Suppose he wanted to sell the Gorgas plant. Would you contend that he could not do it?

Mr. WALDO. Unconditionally? Yes, sir; I would.

The CHAIRMAN. That he could not sell it?

Mr. WALDO. That under these conditions here that Gorgas plant is a part of this whole proposal.

The CHAIRMAN. As to the Gorgas plant, I would not even want to agree with Mr. Ford or anybody else that he should keep it for a hundred years, because you would have asked him to perform there a thing that he can not well do.

Mr. WALDO. He is not asked to maintain that plant for a hundred years, but if he is to sell that plant it must be with the understanding that in the sale he must not interfere with this contract. Now, if he can find a purchaser that would agree to come in and share the responsibility of that contract he might perhaps be able to do as you say if the Gorgas plant were really not necessary to economic operation, which is not the case.

The CHAIRMAN. There would not be any trouble to find a purchaser. They could deed the whole thing, make an absolute sale of it all, and make a big profit out of it. I don't think there is any question about that. There is not anything in the contract that would prevent the corporation from giving a deed to the whole thing the next day.

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Mr. WALDO. Subject to the terms of the contract?

The CHAIRMAN. Yes.

Mr. WALDO. All right, I agree there is not, and if you find a bidder who will agree to underwrite this thing as Mr. Ford has, I will agree with you.

The CHAIRMAN. My own opinion is that the stock will be worth a thousand million the next day after Mr. Ford gets it.

Mr. WALDO. I cannot see the basis for that, Senator. If that is so there should have been many responsible bidders offering to do what Mr. Ford has offered.

The CHAIRMAN. That is the greatest real estate snap that has ever taken place since the beginning of time. They are selling lots down there on the strength of it, and Mr. Ford can go into that business too, if he wants to.

Mr. WALDO. Those things are incidental in connection with this thing. They have already put up the price of property down there to such a point that they are discounting the future. He is a little bit late if he is going to make anything out of that.

The CHAIRMAN. But he is getting a deed to nearly 5,000 acres of land from the Government.

Mr. WALDO. All right, but he can not sell that except under the terms of the contract, and I would not want any of it under such terms, I am sure, and I do not think the average purchaser would want to get any of it and have a cloud on his title of that sort.

Then there is the matter of amortization, Senator. If you have a 100-year period you can set up an amortization that does not affect the cost of the power appreciably in this generation and in the future generations. It has the advantage of bringing these cheap powers of Norway and Canada into the United States, because it removes the biggest part of the cost. That is self-evident.

The CHAIRMAN. Of course amortization, when you spread it out over a 100 years, really becomes nothing. You pay it and don't know it.

Mr. WALDO. You don't know it, that is right. But when you cut that down to 50 years, you would know it.

The CHAIRMAN. You would feel it a little more.

Mr. WALDO. You multiply it by eight.

The CHAIRMAN. On the other hand, if you should run it out over 1,000 years you would not be able to see it with a magnifying glass.

Mr. WALDO. I agree with you. But as a broad policy, if this country would adopt a policy of requiring amortization to be spread over a long term of years, and have those sinking funds set up, there would come a time when there would be cheap power in this country. As it is now the amortization clauses do not run long enough to relieve the power companies of a heavy burden that they are required to carry because there is so short a time, and then when it comes to refinancing, it is not a case of relieving the power company of some of its burden, but it generally means saddling it up with more. They pay commissions—and I do not have any objection to that; I do not say that the man who furnishes the money should not receive a fair return on his investment, nor the man who finances it should not receive a fair return. But if there is a way by means of which this capital can be amortized and returned and the cost of power reduced, it seems to us that any reasonable method of that sort would be a national asset, if it can be made a public policy. Here is one case where the attempt is being made to do that very thing, so that future generations will have power at the mere cost of operating the plant, which means cheaper power than Norway or Canada.

Canada, for instance, is developing power at a very much more rapid rate than the United States; the power developed in Canada per thousand population was 47 horsepower in 1902, 198 horsepower in 1912, and 315 horsepower in 1920, and the horsepower developed in the United States under its policy was 26 horsepower in 1902, 51 in 1912, and 93 in 1920.

The CHAIRMAN. What was the 1920 figure in Canada?

Mr. WALDO. Three hundred and fifteen horsepower.

The CHAIRMAN. Does that take in the whole Dominion of Canada?

Mr. WALDO. Yes, sir.

The CHAIRMAN. That is a wonderful showing for Canada. Is it not true that over in Canada the great bulk of this is developed by the Government itself?

Mr. WALDO. They are undertaking to develop it in Ontario. The Ontario Hydro-electric Power Co. is undertaking, by means of Government control, to make the development.

The CHAIRMAN. Government ownership?

Mr. WALDO. Government ownership; yes, sir.

The CHAIRMAN. And operation?

Mr. WALDO. They are undertaking a plan of that sort. They are having great difficulties with it in spite of their natural advantages.

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The CHAIRMAN. We are hearing in the Senate now, on the tariff question, that they sell power cheaper than they do on this side, and therefore there should be a tariff on the product over here to compete with them. Do you doubt that?

Mr. WALDO. I have been reading a little something about the controversy.

The CHAIRMAN. It seems to be in the tariff argument that Ontario is developing water power cheaper by Government operation in Canada, or in that Province, than is being done in the United States by private operation.

Mr. WALDO. I don't think that the difference in cost is wholly due to the difference in method.

The CHAIRMAN. Why? What do you think makes the difference? Why do they get it cheaper than we do?

Mr. WALDO. I think the conditions in Canada are more favorable than they are in the United States for developing water power at a low cost per installed horsepower.

The CHAIRMAN. Oh, but they take it out of the same river we take it out of. We take it out on one side, and they take it out on the other. The Government does that over there and private capital does it on this side. They can see each other at work. One is Government operation and the other is private operation. Why is it that they do it cheaper than we do?

Mr. WALDO. There are several reasons why they sell power at lower rates. I don't think the Government operation of it is the whole explanation. I think there is a difference in the engineering features and the cost per installed horsepower and in certain arbitrary financial advantages that the Canadian power has. I agree with you that they are getting their money cheaper in Canada than we are getting it. What effect their power plan has on taxation in Ontario is another matter, perhaps they are simply taking the money out of one pocket and putting it into the other, but on the face of it they seem to be doing it more cheaply than we are.

The CHAIRMAN. I should think the condition of the weather would not make much difference, but would it not cost a little bit more to put in a dam in a cold country than in a warm country? Would you not have to take steps to guard against freezing?

Mr. WALDO. That would be a small matter. The Shipshaw site is frozen up with ice all winter long, in northern Canada, and yet it is one of the outstanding examples of Canadian sites where power can be developed at low cost.

The CHAIRMAN. Where is that?

Mr. WALDO. It is about the latitude of Lake St. Johns. It is on the Saugenay River, a tributary of the St. Lawrence River, about 250 miles north of Montreal.

The CHAIRMAN. Do you know what the horsepower is?

Mr. WALDO. No, sir; I can not give you the power available there, and I do not know just how far they have gone with the development of power, but I know there have been surveys made in connection with it, and they show very attractive possibilities.

The CHAIRMAN. How is that power developed in Norway? Is it by the government?

Mr. WALDO. The government is doing some of it, yes, but most of the power developed in Norway was developed by private capital. Water power rights are granted for 80 years. Of course, they do not have to build large dams there.

NOTE.—In Norway both the municipalities and the State are acquiring water power for lighting the streets and electrifying the railroads.

Foreign capital has acquired large power rights and foreign companies are now practically excluded from acquiring water power unless controlled by Norwegian directors.

A large part of Norwegian power is used for electrothermal purposes and important exports include calcium carbide, cyanamide, ammonium nitrate, calcium nitrate, and metallic zinc and copper.

"Norwegian working men are fortunate in that a relatively large number of factories are situated in the country district than is the case in other lands; in 1909, 57 factories out of every 100 were in the country. The clear and sootless electrical and electrochemical industries provide intellectual rather than manual labor."—H. G. Leach.

The CHAIRMAN. They seem to have the cheapest water power in the world.

Mr. WALDO. Because of the topography. The rivers, I understand, are long and the country flat, and when they reach the sea they drop hundreds of feet vertically, practically, over a precipice, and all that is necessary is to pipe the water. You do not have to do anything more than divert the water at the head works.

The CHAIRMAN. Have you ever been in Norway?

Mr. WALDO. No, sir; I have not, but I have read a number of descriptions of their conditions. Dr. Samuel Eyde's paper of September 7, 1912, contains an especially interesting description of Norway power development. We have been hearing through the technical press about the enormous amount of water power that is being developed in the United States. There are applications totaling some 19,400,000 horsepower, according to Mr. O. C. Merrill's statement, reported in Power of April 18, 1922, but we are getting only 600,000 horsepower of primary power being built. When you

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investigate the individual cases you find that in many instances those are power companies who for special reasons are going ahead with their developments, not because of the great benefit that this water power law has been to them but because of certain special conditions that existed prior to the passage of the act.

The CHAIRMAN. Of course there is a great deal that is applied for that will never be taken out, I presume.

Mr. WALDO. Yes, sir; doubtless.

The CHAIRMAN. Under the law they have a certain time after application. They may never develop and undoubtedly a great deal of it never will be developed.

Mr. WALDO. No doubt that part of the power that can be developed commercially will be developed.

The CHAIRMAN. They are investigating. That is about what it means.

Mr. WALDO. Now when you examine the testimony and literature that has been distributed against the Ford proposition, against this project when it was proposed to operate it by the Government, against the development of Muscle Shoals in any kind of a form, those people that advocated that this plant should be scrapped, you find that there are a few States in which that opposition is largely located. Those States, I regret to say, because I happen to be a native of one of them, are the New England States and New York, Pennsylvania, and New Jersey. The use of fertilizer in this country, Mr. Chairman, is growing tremendously, and the latest census reports, which only recently came out, show that in 1909 the farmers of this country spent $114,882,541 for fertilizers, and in 1919 they spent $326,399,800, an increase of about 184 per cent.

The CHAIRMAN. In 10 years?

Mr. WALDO. In 10 years, yes, sir. That shows how great an element fertilizer is coming to be in everybody's program in agricultural operations, no matter where they are operating; and the significant thing is that the greatest percentage of increase is in the Western States, in those States where hitherto there has been practically no fertilizer used. Take your own State of Nebraska, Senator. In 1909 there was about 31,000 tons used. In 1919 there were 64,000 tons. The use has practically been doubled. Now I would like to put into the record, if I may, just for reference, these expenditures by States.

Farm expenditures for fertilizers.

[From United States Census.]

	1919	1909
Geographic divisions:		
New England	$18,322,697	$9,407,759
Middle Atlantic	41,438,394	18,221,474
East North Central	30,589,412	8,058,881
West North Central	6,168,742	983,216
South Atlantic	185,700,177	59,625,130
East South Central	25,476,855	12,901,239
West South Central	8,696,846	3,225,927
Mountain	808,518	159,342
Pacific	9,198,159	2,299,573
New England:		
Maine	7,759,067	4,069,479
New Hampshire	526,180	512,590
Vermont	857,273	570,752
Massachusetts	3,906,733	1,965,682
Rhode Island	379,786	335,103
Connecticut	4,893,658	1,954,163
Middle Atlantic:		
New York	15,067,371	7,142,265
New Jersey	10,742,682	4,277,604
Pennsylvania	15,628,341	6,801,605
East North Central:		
Ohio	13,206,018	4,180,485
Indiana	8,734,698	2,189,695
Illinois	2,996,403	615,594
Michigan	4,872,543	945,354
Wisconsin	779,750	127,753
West North Central:		
Minnesota	432,680	74,653
Iowa	596,537	109,570
Missouri	3,941,488	671,073
North Dakota	119,782	10,003
South Dakota	34,466	11,294
Nebraska	64,752	31,021
Kansas	979,037	75,602
South Atlantic:		
Delaware	$1,222,329	$864,577
Maryland	7,610,478	3,387,634
District of Columbia	23,267	16,975
Virginia	17,277,705	6,932,455
West Virginia	1,709,546	528,937
North Carolina	48,796,094	12,262,533
South Carolina	52,546,795	15,162,017
Georgia	46,196,434	16,860,149
Florida	10,316,929	3,609,853
East South Central:		
Kentucky	3,597,449	1,350,720
Tennessee	3,525,133	1,216,296
Alabama	14,066,108	7,630,952
Mississippi	4,288,165	2,703,271
West South Central:		
Arkansas	2,572,678	596,553
Louisiana	3,840,469	2,004,919
Oklahoma	452,492	29,092
Texas	1,831,207	595,363
Mountain:		
Montana	126,232	12,323
Idaho	103,121	20,737
Wyoming	8,489	5,302
Colorado	294,448	61,113
New Mexico	113,483	25,571
Arizona	40,892	6,080
Utah	108,956	20,037
Nevada	9,897	8,379
Pacific:		
Washington	525,637	87,023
Oregon	489,524	68,557
California	8,182,998	2,143,993
United States	326,399,800	114,882,541

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The CHAIRMAN. All right, Mr. Waldo.

Have you got the statistics there as to the amount of fertilizer used by each State?

Mr. WALDO. By States, yes, sir.

The CHAIRMAN. Put that in in the record.

Mr. WALDO. I have it to go into the record. This will show the total fertilizer consumption for previous years. That is valuable for comparison.

[From Hearings before House Committee on Military Affairs on Muscle Shoals Propositions, Sixty-seventh Congress, second session, p. 96.]

State.	Fiscal year ending—	1913	1914	1915	1916	1917	1918	1919	1920
		Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
Alabama	Oct. 1	434,730	592,200	302,350	206,000	216,000	289,990	297,903	388,341
Arizona [1]	June 30	600	650	650	600	500	500	500	500
Arkansas	Sept. 30	52,000	94,850	26,396	65,600	58,500	88,500	64,427	81,875
California	June 30	36,000	39,471	31,540	29,415	43,964	32,036	43,126	58,626
Colorado [1]	Dec. 31	500	500	600	1,000	1,000	1,000	1,000	1,000
Connecticut [1]	...do	62,000	74,000	80,000	73,000	78,000	80,000	65,000	65,000
Delaware [1]	...do	50,000	55,000	45,000	45,000	50,000	54,000	30,398	61,537
Florida	...do	213,728	240,812	208,782	212,250	214,088	197,954	250,613	272,316
Georgia	...do	1,120,693	1,282,088	872,979	741,347	895,897	923,029	990,919	978,080
Idaho [1]	July 1	200	500	500	500	500	500	500	500
Illinois [1]	Apr. 30	30,000	40,000	35,000	42,000	45,000	45,000	45,000	45,000
Indiana	Dec. 31	193,899	219,000	156,152	132,159	156,000	244,340	241,000	230,184
Iowa [1]	Apr. 30	3,500	4,200	5,100	5,000	5,000	5,000	5,000	5,000
Kansas	Dec. 31	7,380	9,460	10,600	7,940	7,600	8,000	16,937	12,650
Kentucky [1]	...do	75,000	83,000	85,000	62,000	93,000	128,000	103,000	90,000
Louisiana	Aug. 31	98,778	90,588	73,420	96,426	98,264	81,025	97,724	95,864
Maine [1]	Dec. 31	160,000	168,000	150,000	155,000	160,923	155,000	156,000	168,000
Maryland	...do	169,000	183,350	168,000	154,000	191,900	173,000	174,500	173,000
Massachusetts [1]	June 30	51,000	54,000	56,000	53,000	64,000	68,000	61,000	61,450
Michigan [1]	Dec. 31	57,985	60,000	65,000	70,000	91,455	78,000	103,264	112,616
Minnesota	...do	3,500	3,800	4,000	4,500	4,500	5,000	5,000	5,000
Mississippi	Oct. 1	128,050	127,400	85,414	75,667	76,717	104,700	110,000	139,000
Missouri [1]	Dec. 31	60,000	65,000	57,000	41,000	65,000	90,000	91,000	120,332
Montana [1]	No law	800	900	1,000	1,000	1,000	1,000	1,000	1,000
Nebraska [1]	...do	500	500	500	500	500	500	500	500
Nevada [1]	...do	800	950	1,000	1,000	1,000	1,000	1,000	1,000
New Hampshire [1]	Apr. 30	18,000	20,000	16,000	18,000	20,000	18,000	14,000	17,000
New Jersey	Oct. 31	156,661	155,414	153,075	129,800	176,483	153,198	149,485	164,830
New Mexico [1]	No law	200	200	500	500	500	500	1,500	1,500
New York [1]	Dec. 31	380,000	420,000	400,000	400,000	420,000	430,000	410,000	400,000
North Carolina	Dec. 1	840,447	872,820	647,188	650,000	849,728	921,962	961,238	1,221,796
North Dakota [1]	Dec. 31	500	550	600	700	1,000	1,000	1,000	1,000
Ohio	...do	183,476	203,000	225,000	187,848	165,857	219,328	305,236	300,000
Oklahoma [1]	June 30	2,000	2,000	2,000	3,000	3,000	3,000	4,000	4,000
Oregon [1]	Aug. 30	4,500	6,300	6,500	6,500	7,000	6,000	7,500	5,500
Pennsylvania	Dec. 31	340,000	381,900	316,319	268,455	334,309	340,898	340,000	336,864
Porto Rico [1]	June 30	18,836	18,164	20,000	37,725	45,767	40,811	21,815	20,000
Rhode Island [1]	Mar. 31	9,000	12,500	11,000	12,000	11,500	10,000	9,000	10,000
South Carolina	June 30	918,336	1,095,728	670,610	833,624	850,790	1,064,886	1,033,887	1,253,880
South Dakota [1]	July 1	700	1,000	1,500	1,500	2,500	2,500	3,000	3,000
Tennessee	May 31	84,060	93,550	77,390	91,128	99,584	113,000	109,366	112,202
Texas	Sept. 1	75,500	77,400	17,500	39,845	40,500	58,000	46,000	36,700
Utah [1]	Dec. 31	1,000	1,200	1,500	1,000	1,000	1,000	1,000	1,000
Vermont [1]	June 30	14,500	18,000	13,500	15,000	14,500	16,000	18,000	20,000
Virginia	Dec. 31	412,434	437,808	403,077	369,520	496,217	430,549	421,484	429,084
Washington [1]	Mar. 31	1,500	2,400	3,000	3,000	4,000	4,010	4,000	4,000
West Virginia	June 30	31,852	35,475	46,010	40,000	41,000	59,036	68,000	121,052
Wisconsin [1]	Dec. 31	4,000	4,500	5,000	5,000	6,500	7,500	10,000	12,000
Wyoming [1]	No law	200	400	500	500	500	500	500	500
Total		6,544,345	7,340,528	5,563,212	5,390,549	6,208,543	6,756,743	6,891,322	7,654,239
Hawaii	June 30	67,000	80,000	70,000	65,000	80,000	64,000	71,000	70,680

[1] Estimated.

In looking over this situation, Senator, we find a striking thing, that these nine States—Maine, New Hampshire, Vermont, Massachusetts, Connecticut, Rhode Island, New York, New Jersey, and Pennsylvania—where the opposition to any kind of fertilizer plant at Muscle Shoals seems to be centered——

Senator HEFLIN (interposing). How do you account for that?

The CHAIRMAN. He is just about to tell us, I suppose.

Mr. WALDO. I want first to get the situation here.

In 1909 those States spent $20,957,397 for fertilizer. In 1919 they had increased about 111.2 per cent, and were spending $44,276,981 for fertilizer. And what was

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happening? During that same period their population was increasing from 14,507,407 to 29,662,053, an increase of 103 per cent or an annual increase of about 378,866 people. But the improved lands in farms in 1880 was 46,385,632 acres. In 1920 it was 32,676,-708. Agriculture has been abandoned on 13,708,924 acres, a decrease of nearly 30 per cent, and an annual decrease of about 342,723 acres. The total number of farms decreased from 692,999 to 577,797, or a decrease of 115,202, an annual decrease of 2,880 farms. In other words, on an average 2,880 farms went out of business every single year for the last 40 years in this particular territory. What has the Government been doing in the way of increasing the farm acreage through its Reclamation Service? Between 1913 and 1921 the total increase was 532,858 acres, or 66,607 acres a year. In other words, for every acre that we have brought under cultivation by our efforts as a Government through the Reclamation Service, 5.2 acres have been abandoned by the farmer in the East who found that he could make more money by doing something else than farming. Why could he make more money by doing something else? Because the returns per acre that he had in cultivation were so small that he could go to the towns and make more money per day, or he could go farther West, and it is well known, of course, that the Central West was settled by people from New England. If we continue at this rate—and I will put the data into the record—how long will it be before we will have little or no agriculture in these Eastern States?

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Population of Eastern States.

Year.	Maine.	New Hampshire.	Vermont.	Massachusetts.	Connecticut.	Rhode Island.	New York.	New Jersey.	Pennsylvania.	Total.
1880	648,936	346,991	332,286	1,783,085	622,700	276,531	5,082,871	1,131,116	4,282,891	14,507,407
1890	661,086	376,530	332,422	2,238,947	746,258	345,506	6,003,174	1,444,933	5,258,113	17,406,965
1900	694,466	411,588	343,641	2,805,346	908,420	425,556	7,268,894	1,883,669	6,302,115	21,043,695
1910	742,371	430,572	355,956	3,366,416	1,114,756	542,610	9,113,614	2,537,167	7,665,111	25,868,573
1920	768,014	443,083	352,428	3,852,356	1,380,631	604,397	10,385,227	3,155,900	8,720,017	29,662,053
40-year increase	119,078	96,092	20,142	2,069,271	757,931	327,866	5,302,356	2,024,784	4,437,126	15,154,646
Per cent increase	18.4	27.6	6.0	116.0	121.7	118.5	104.3	179.0	103.6	103.0
Average annual increase	2,977	2,402	503	51,732	1,895	8,197	132,559	40,619	110,928	378,866

Improved land in farms (acres).

Year.	Maine (33,040 square miles).	New Hampshire (9,341 square miles).	Vermont (9,564 square miles).	Massachusetts (8,266 square miles).	Connecticut (4,965 square miles).	Rhode Island (1,248 square miles).	New York (49,204 square miles).	New Jersey (8,224 square miles).	Pennsylvania (45,126 square miles).	Total (168,978 square miles).
1880	3,484,908	2,308,112	3,286,481	2,128,311	1,642,188	298,486	17,717,862	2,096,297	13,423,007	46,385,632
1890	3,044,666	1,727,387	2,656,943	1,657,024	1,379,419	274,491	16,389,380	1,999,117	13,210,597	42,338,044
1900	2,386,889	1,076,879	2,126,624	1,292,132	1,064,525	187,354	15,599,986	1,977,042	13,209,183	38,920,614
1910	2,360,657	929,185	1,633,965	1,164,501	988,252	178,344	14,844,039	1,803,336	12,673,519	36,575,798
1920	1,977,329	702,902	1,691,595	908,834	701,086	132,855	13,158,781	1,555,607	11,847,719	32,676,708
40-year decrease	1,507,579	1,605,210	1,594,866	1,219,477	941,102	165,631	4,559,081	540,690	1,575,288	13,708,924
Per cent decrease	43.2	69.5	48.5	57.3	57.3	55.5	25.8	25.8	11.7	29.5
Average annual decrease	37,689	40,130	39,871	30,487	23,527	4,140	113,977	13,517	39,382	342,723

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Number of farms.

Year.	Maine (33,040 square miles).	New Hampshire (9,341 square miles).	Vermont (9,564 square miles).	Massachusetts (8,266 square miles).	Connecticut (4,965 square miles).	Rhode Island (1,248 square miles).	New York (49,204 square miles).	New Jersey (8,224 square miles).	Pennsylvania (45,126 square miles).	Total (168,978 square miles).
1880	64,309	32,181	35,522	35,266	30,598	6,216	241,058	34,307	213,542	692,999
1890	62,013	29,151	32,573	31,177	26,350	5,500	226,223	30,828	211,557	655,372
1900	59,299	29,324	33,104	32,581	26,948	5,498	226,720	34,650	224,248	672,372
1910	60,016	27,053	32,709	32,075	26,815	5,292	215,597	33,487	219,295	652,339
1920	48,227	20,523	29,075	28,087	22,655	4,083	193,195	29,702	202,250	577,797
40-year decrease	16,082	11,658	6,447	7,179	7,943	2,133	47,863	4,605	11,292	115,202
Per cent decrease	25.0	36.2	18.1	20.4	25.9	34.3	19.9	13.4	5.2	16.62
Average annual decrease	402	291	161	180	198	53	1,198	115	282	2,880

Average acreage of improved land per farm (acres).

Year.	Maine.	New Hampshire.	Vermont.	Massachusetts.	Connecticut.	Rhode Island.	New York.	New Jersey.	Pennsylvania.	Average.
1880	54.2	71.7	92.5	55.4	53.7	48.0	73.5	61.1	62.9	63.66
1890	49.1	59.3	81.5	48.2	52.3	49.9	72.4	64.8	62.4	59.99
1900	40.3	36.7	64.2	34.3	39.5	34.1	68.8	57.1	58.9	48.21
1910	39.3	34.3	50.0	31.5	36.9	33.7	68.8	53.9	57.8	45.13
1920	41.0	34.2	58.2	28.4	30.9	32.5	68.1	52.4	58.6	44.92
40-year decrease	13.2	37.5	34.3	27.0	22.8	15.5	5.4	8.7	4.3	18.74
Per cent decrease	24.3	49.2	37.0	48.7	42.4	34.3	7.3	14.2	6.8	29.35

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Use of commercial fertilizers in Eastern States (tons).

Years.	Maine.	New Hampshire.	Vermont.	Massachusetts.	Connecticut.	Rhode Island.	New York.	New Jersey.	Pennsylvania.	Total.
Total, 1912	150,000	15,000	12,000	48,000	48,000	8,000	376,000	140,000	318,716	1,115,716
Total, 1919	166,000	14,000	18,000	61,000	65,000	9,000	410,000	149,485	340,000	1,222,485
Increase	6,000	1,000	6,000	13,000	17,000	1,000	34,000	9,485	21,284	106,769
Per cent increase	4.0	−6.7	50.0	27.0	35.4	13.0	9.0	6.8	6.7	9.6

Expenditures of farmers for commercial fertilizers in Eastern States.

Years.	Maine.	New Hampshire.	Vermont.	Massachusetts.	Connecticut.	Rhode Island.	New York.	New Jersey.	Pennsylvania.	Total.
1909	$4,069,479	$512,580	$570,752	$1,965,682	$1,954,163	$335,103	$7,142,265	$4,277,604	$129,769	$20,957,397
1919	7,759,067	526,180	857,273	3,906,733	4,893,658	379,786	15,067,371	10,742,682	144,231	44,276,981
Increase	3,689,588	13,600	286,521	1,941,051	2,939,495	44,683	7,925,106	6,465,078	14,462	23,319,584
Per cent increase	90.7	2.7	50.2	98.7	150.4	13.3	110.9	151.1	11.1	111.2

Data from United States census.

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The CHAIRMAN. That is exceedingly interesting, but haven't you left out one thing? It seems to me the only increase you have shown has been the increase from reclamation. There have been other increases besides that.

Mr. WALDO. That is true, but we have now come to the limit of those increases, as everyone agrees. During the period from 1880 on, of course, there were large acreages taken up in the West, but during the last 10 years the western territory has been pretty fully taken up, and what we can expect to get is what little can be had through reclamation by irrigation or drainage.

The CHAIRMAN. Do you think that accounts for the opposition you say comes from that group of States you have named?

Mr. WALDO. No, sir; I don't say it accounts for it, but I say that their opposition is strangely short sighted when agriculture is being abandoned at such a rate that the State of New York issues a book about the size of this one, or a little bit thicker, listing and describing not less than 1,200 farms that are offered for sale. A man who has a farm for sale can have it advertised free of charge in that book, which is sent out broadcast over the country, trying to induce people to come there and farm those worn out lands. We say if we can reduce the cost of fertilizer the cultivation of those lands can be made profitable. Whenever those lands can be cultivated profitably, they will be farmed and the taxable value will greatly increase.

The CHAIRMAN. Now, I agree with all of that, Mr. Waldo, but I have not found—I have not looked it up, and may be you are entirely right—that the opposition to any kind of development there is confined to those States. That may be true. I just happen to think now of one member of the committee of the House that came back when they defeated this proposition in the House a couple of years ago was from the State of Nebraska.

Mr. WALDO. I do not say, Senator, that all of the opposition to the development of Muscle Shoals is confined in those States, but a very large part of it comes from there.

The CHAIRMAN. I was on the committee when that was heard before. I know from private conversation with members of the committee and other Members of the Senate, but particularly members of the committee, there was a good deal of doubt as to how they would vote in this meeting on Muscle Shoals, and there was not any of them that was opposed to anything that would bring about improvement of the fertilizer situation; but they formed the idea that this was a great big graft down there in Alabama; that the Government might just as well quit it. And coupled with that thought, a great many of them held—I did not agree with them—that the Government never ought to do anything, and therefore they had better charge it off as a war loss and just let that whole project be scrapped.

When you speak about propaganda against the proposition, I have been here a good many years, and of all the things I have ever taken hold of or had anything to do with I have never yet found anything that exceeded the propaganda trying to influence Congress in favor of the Ford proposition. I want to tell you that I get it from all over the United States, particularly from my own State, all kinds of propaganda denouncing me because I won't favor Ford's proposition.

Mr. WALDO. Senator, do you consider honest expression of opinion as propaganda?

The CHAIRMAN. What is that?

Mr. WALDO. I say do you consider honest expression of opinion as propaganda?

The CHAIRMAN. No. Not by any means. And I am not opposed to propaganda. We have got to meet that, and anybody that can not meet it ought to go home. But there are people right now running for Congress on the Ford proposition. I am not blaming Mr. Ford, Mr. Waldo, nor you. As far as I know, any of you people that have been here have all been on a much higher basis than that. You have been perfectly square and honorable, so far as I know. But there is one of the greatest propagandas that has ever been put forth, that I have ever had anything to do with.

Senator HEFLIN. And the fertilizer fellows are sending out their propaganda.

The CHAIRMAN. It may be, and it has been charged all along that there is a fertilizer trust, and I believe it, because I knew nothing about it, and because I heard Senator Heflin repeat it so many times.

Senator HEFLIN. Yes. There is no doubt about it.

The CHAIRMAN. There have been men on the witness stand, and I had here and examined the fellow that is the head of the fertilizer organization, the man who has been most active in this fertilizer business who, if there is a fertilizer trust, was the head of the trust. So far as the testimony before this committee is concerned, if it was submitted to a jury, no jury could find that there is such a thing as a fertilizer trust. I have announced to Senator Heflin that I will get anybody in the United States that he wants to get here to testify about the Fertilizer Trust.

Senator HEFLIN. I don't have to have any proof. Every farmer in the country that buys fertilizer knows they have got one.

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The CHAIRMAN. That may be true, but it has not been proven here, and I don't think anybody will charge me with being a friend of the fertilizer trust.

Senator HEFLIN. Silver and Bower both testified there was a trust.

The CHAIRMAN. What is that?

Senator HEFLIN. Silver and Bower both testified there was a trust. I asked them if this would not relieve them from the fertilizer trust, and they said it would.

The CHAIRMAN. Oh, yes; but that does not prove that there is a trust. I defy any man to point to any evidence that we have here from which one could properly draw the conclusion that there is a fertilizer trust.

Mr. WALDO. And you believe that there is not a combination of interests that are determined to put this thing down by hook or crook if they can do so?

The CHAIRMAN. That has not been developed here.

Senator HEFLIN. I don't feel that way about it.

Mr. WALDO. Have you ever seen the colored circular sent to Congress from the National Fertilizer Association?

The CHAIRMAN. No. They have never sent it to me.

Mr. WALDO. You have never seen the booklet published by the by-product coke oven people?

The CHAIRMAN. I have a stack of stuff down in my office. I have a lot of stuff that would fill this table.

Mr. WALDO. Who has it come from?

The CHAIRMAN. They come from a lot of people who tell me, "If you don't get behind the Ford offer we will defeat you when you run for reelection." You can not go down in Alabama to-day and run for office and be elected unless you are for Ford.

Mr. WALDO. Because of what those people think the Ford proposition will do for the United States.

The CHAIRMAN. I think so. Not particularly for the United States, but a good many of these people are looking after their own interests. Why, we have an office right here in Washington for the purpose of selling lots. I have over in my desk an advertisement right now of lots at Muscle Shoals.

Mr. WALDO. Well, we don't know anything about that.

The CHAIRMAN. I don't charge it to you. I have not said so.

Mr. WALDO. That is not legislative propaganda, Senator.

The CHAIRMAN. Yes; that is propaganda. Those people expect to make millions, and are offering land for sale now, and want to get the first payment on a lot. I suppose they are working for Ford. Every one of them is doing everything he can, advertising in the papers. I saw an advertisement in a Washington paper just the other day that said: "Come down to the office and buy your lot and make your first payment. There is going to be a big city there."

Mr. WALDO. There may be a few real estate people who are trying to put over something of that sort.

The CHAIRMAN. I would not mention that, Mr. Waldo, except when you commence to talk about the great propaganda that is opposed to Ford. There are lots of people that are opposed to Ford and opposed to what I have introduced, and opposed to every other bidder, because they are opposed to the Government doing anything down there. There are lots of such people, and I have assumed that they are honest in their convictions. I have not tried to go behind what is right out on the face. They are just as bitterly opposed to the bill that I have introduced as they are to Ford's proposition.

Mr. WALDO. The point I want to make, Senator, is that the opposition that come to this development of Muscle Shoals is not the opposition of the man on the street; it is the opposition of the fellow who does not want to see anything done, because he does not want Mr. Ford to interfere with what he is doing.

The CHAIRMAN. I have no doubt but what that is true. On the other hand, there is the fellow in favor of Ford who has nothing in it in the world but dollars. He expects to get rich.

Mr. WALDO. Well, he is very much in the minority, unless you include the farmers of the country, who really expect to get a benefit.

The CHAIRMAN. No; I don't mean the farmer. I am not including the farmer.

Mr. WALDO. Then I think they are very much in the minority, Senator.

The CHAIRMAN. They are able to pay for advertisements in the newspapers of the country.

Mr. WALDO. The basis on which I make my statement, Senator, is a different one entirely. We secure clippings through these clipping bureaus, to obtain the true feeling throughout the country on the Ford proposal, as judged by the editorials that appear in the different papers, and we find an almost universal sentiment for this thing except in a very definite location.

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The CHAIRMAN. Of course, I can not contradict that.

Mr. WALDO. I do not offer any explanation for that, but I say it is short-sighted for those people to take that view, because they are the ones who need, as much as any other section of the country, the results that can be obtained from such a thing as this.

The CHAIRMAN. Yes. I think they need them more.

Mr. WALDO. There are many other water powers in the United States, notably out in the West, in Senator Kendrick's State, for instance, Wyoming, where they have untold millions of tons of phosphate rock and water power close by, and a supply of alunite—aluminum, sulphuric acid, and potash—and of course the nitrogen of the air is as available there as anywhere, so that what we really look for is that this thing will simply be an operation preliminary to a very much larger development out in the far West, and for the reason that it will be possible to produce those very highly concentrated plant foods that no one is producing at this time for the American market I mean ammonium phosphate, for example, which is the kind of fertilizer that would be produced at Muscle Shoals, containing about 15 per cent of ammonia and about 62 per cent of phosphoric acid. There is a total of approximately 77 per cent of plant food as against the 12 to 14 per cent material which is in use to-day.

It is because of those possibilities that there is such widespread interest in this case. Of course if these farm organizations did not inform the people about it and did not bring the facts to their attention, then Congress can not know what they are thinking about it.

Senator, after our studies of this thing we have concluded that the net gain to the Government under the Ford offer is $75,000,000 in the lease period. This takes into account the fact that he does not pay interest during the construction period up to the time when the first 100,000 horsepower is installed and ready for service at Dam No. 2, and 80,000 horsepower is installed and ready for service at Dam No. 3. It takes into account the interest after construction that he pays, and the interest that the Government must pay under the circumstances. It includes the depreciation which Mr. Ford carries on the nitrate plant at the rate of depreciation figured by the Ordnance Department, which is not, as they say themselves, the rate of depreciation that would be figured by a commercial organization. It includes the savings in guarding the nitrate plant, and takes into account the possible lease value of the steam plant at nitrate plant No. 2 for a hundred years, and includes what was testified as the probable value of the lease of the Gorgas steam plant, for a hundred years, and then figuring the value of the elimination of the Muscle Shoals Canal at the present rate of expense, $53,000 per year—last year it was $67,000. It includes Mr. Ford's retirement fund and gives him credit for the Government's cost of maintaining a fixed nitrogen research laboratory now being carried on at $250,000 a year. We do not figure any compound interest except on that item which constitutes the sinking fund that this plan proposes to set up. I have very little patience with those people who figure compound interest on Government expenditures, because it is a well known fact that no Government expenditures can carry compound interest and none ever have. One does not lose that which one never had and never had a chance to have. No one ever offered to return compound interest on any Government expenditure that I know of. Figuring compound interest on a sinking fund that will actually be set up and administered so as to earn compound interest is quite another matter.

The CHAIRMAN. Of course I have not seen those figures that you have given, but let us take one of them. Do you want to put them in the record?

Mr. WALDO. Yes, sir.

The Muscle Shoals account under the Ford offer.

Items.	Debit.	Credit.	Remarks.
Government interest during construction:			
On Dam No. 2, 4 per cent on $25,000,000 for one-half of 3 years.	$1,500,000	.....	United States Engineers estimate of cost to complete these dams is $50,000,000 (H. R. Doc. 167, 67th Cong., 2d ses., p. 21. United States Engineers estimate of time required, same reference as above (p. 22).
On Dam No. 3, 4 per cent on $25,000,000 for one-half of 3 years.	1,500,000	.....	

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The Muscle Shoals account under the Ford offer—Continued.

Items.	Debit.	Credit.	Remarks.
Interest after construction, 4 per cent on $50,000,000 for 97 years.	$194,000,000	.....	Mr. Ford pays 4 per cent on the cost of the dams, whatever that cost may be, after a preliminary period during which payments are as shown. These figures assume that the first 80,000 horsepower will be ready at Dam No. 3 in 2 years after the first 100,000 horsepower is ready at Dam No. 2.
Ford interest payments:			
Account Dam No. 2—			
6 payments of $200,000...$1,200,000			
94 payments of $1,000,000..94,000,000			
	.....	$95,200,000	
Account Dam No. 3—			
3 payments of $160,000.....480,000			
95 payments of $1,000,000..95,000,000			
	.....	95,480,000	
Depreciation on nitrate plant No. 2 during lease period, 100 years, at $400,000.	.....	40,000,000	Nitrate plant to be maintained under Ford offer for 100 years without expense to Government. This plant would actually have to be rebuilt at least four times. Letter of General Williams to Congressman James, June 6, 1922.
Guarding nitrate plant No. 2, 100 years, at $100,000.	.....	10,000,000	
Possible value of lease of steam plant at nitrate plant No. 2, to Alabama Power Co.	20,000,000	.....	Letter of General Williams, above.
Probable value of lease of Gorgas steam plant to Alabama Power Co., 100 years, at $75,000.	7,500,000	.....	Letter of Secretary Weeks to Speaker of House, Feb. 1, 1922.
Value of elimination of Muscle Shoals Canal, 100 years' expense at annual average of $53,000.	.....	5,300,000	Mr. Ford pays $55,000 annually for maintaining locks in new dams.
Ford retirement fund in 100 years.....	.....	49,000,000	Approximate total of an annuity provided by Mr. Ford invested at 4 per cent.
Relieves Government of cost of operating its fixed nitrogen research laboratory "established under the national defense act of 1916 and now being operated at an average annual cost of $250,000, 100 years, at $250,000.	.....	25,000,000	Mr. Ford agrees to maintain a laboratory for the same purposes as those of the fixed nitrogen research laboratory.
Total.....	224,500,000	319,980,000	
Net gain to Government under Ford offer during lease period.	.....	95,480,000	

The CHAIRMAN. You have an item there of $250,000 a year for a hundred years for investigation purposes.

Mr. WALDO. I wish we had done that for the past hundred years.

The CHAIRMAN. So do I. But tell me what part of Mr. Ford's bid provides for the expenditure of $250,000 a year by this corporation in investigation.

Mr. WALDO. Not that amount of money, but the undertaking that he agrees to is such as can reasonably be expected to amount to that. It will eliminate the necessity for a $250,000 operation on the part of the Government.

The CHAIRMAN. The point I am wondering about is why will this corporation build that. It is under no obligation to spend $250,000 a year. Suppose they say that is too much, and they will spend a thousand dollars a year instead. Have they violated their contract?

Mr. WALDO. Yes, sir.

The CHAIRMAN. How? What part of it?

Mr. WALDO. Because the spirit of this contract is that this thing shall be of such magnitude as to produce a useful result, and if Mr. Ford violates the spirit of this thing when it is established in such a well-known way in the minds of a hundred million people, he might just as well violate the terms out and out.

The CHAIRMAN. But when you get into court you won't rely on the hundred million people at all. The judge will look at the contract and say, "What does the bond say? That does not provide for an expenditure of $250,000 a year in this proposition, and they have not violated the contract if they spend only $250." Where is the part of the contract that they have violated? Tell me that.

Mr. WALDO. The idea in this proposal is that you are undertaking to put into operation a sufficient amount of research work to accomplish useful results.

The CHAIRMAN. Who says that? Who passes on that?

Mr. WALDO. Any court would pass on that.

The CHAIRMAN. No; but this corporation that Mr. Ford sets up is the one that is going to pass on that.

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Mr. WALDO. But there are going to be people who will benefit by such an operation.

The CHAIRMAN. Suppose the Government would come along and say, "You have only spent a thousand dollars here," and they would say, "With that thousand dollars we have made all the investigation possible"; and they are the ones to decide it, and whether this corporation does it or not, the Government, of course, will go on, I hope, with its investigation just the same.

Mr. WALDO. Certainly, Senator, but you are in a commercial operation. Suppose I am in business. I will say that I will not deliberately break my contract that I have made with my customers. I have built up a tremendous business here, we will say, and have customers all over the country, and then instead of actually breaking my contract with them, by some more or less evasive means I manage to beat the spirit of the thing that I entered into, how long would my company last?

The CHAIRMAN. It would not hurt your company a bit. You have not violated the agreement.

Mr. WALDO. I have lost my customers. I no longer have their good will.

The CHAIRMAN. You have not lost your customers. They don't know whether you have been spending $200,000 or less.

Mr. WALDO. They are represented on my board of directors.

The CHAIRMAN. As to how much you would have to spend in research work, the corporation will decide. This corporation that has not yet come into existence is going to decide, like any other corporation, how much they shall spend. If they want to spend $250,000 they will spend that much, and if they want to spend $25,000 they will spend that, and they have not violated any contract.

Mr. WALDO. But they have violated the intention of the contract.

The CHAIRMAN. I can not see that they have violated the intention of the contract when that is done. There is not anything in it that binds them to do it. The only objection I have to the argument of you fellows is that there are so many mysteries and uncertainties that God Almighty himself does not know about now. You can not know, Mr. Waldo, because it is not stated so in Mr. Ford's bid.

Senator HEFLIN. The Bible says God Almighty knows all things.

The CHAIRMAN. Well, there are some things that are not included in "all things."

Mr. WALDO. Here is one of the things that is included, Senator:

"To determine by research whether by means of electric furnace methods and industrial chemistry there may be produced on a commercial scale fertilizer compounds of higher grade and at lower prices than fertilizer using farmers have in the past been able to obtain, and to determine whether in a broad way the application electricity and industrial chemistry may accomplish for the agricultural industry of the country what they have economically accomplished for other industries, and if so found and determined, to reasonably employ such improved methods."

The CHAIRMAN. You say this corporation is going to spend $250,000 a year on that provision of the contract?

Mr. WALDO. Probably more.

The CHAIRMAN. Now, I can't say that they won't spend $40,000,000 on it. I couldn't say that. I couldn't deny it. But I do say that they are under no obligation by contract to spend $250,000. You could determine in a broad way whether you could do that better this way or that way, and you could hire a man at $500 a year, if you could get him that cheap, and say this corporation has determined on that as being a compliance with the contract, so far as that proposition is concerned. I do not say it in a critical sense, but I do say that there is no obligation there which requires the expenditure that would entitle you to include that $250,000, yet you have included it in your figure—$250,000 for a hundred years.

Mr. WALDO. Because that will certainly take the place of what you are now doing. Otherwise he would not be doing what the intent of the contract calls for.

The CHAIRMAN. Have you ever heard even Mr. Ford say that he expected to spend $250,000?

Mr. WALDO. Yes sir; on one single process. He expects to spend $250,000 on one single process. He has it to spend, and that is one reason why we are for Mr. Ford. Who else is going to do that?

The CHAIRMAN. Ford has not agreed to do it. Why doesn't he put it in the contract that he is going to spend $250,000 a year?

Mr. WALDO. That is another matter.

The CHAIRMAN. Of course it is. He won't be bound to do it.

Mr. WALDO. Not for $250,000, he may get the same results as the Government's $250,000 a year laboratory for less than that expenditure, but he will be bound for a thing that he knows will probably cost him $250,000 or more.

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The CHAIRMAN. Let him put it in the contract. He won't put it in the contract, and he wouldn't sign it if it was in there.

Mr. WALDO. I am not in position to speak for him, but I would certainly think that he would be willing to do a thing of that sort as a matter of business.

The CHAIRMAN. I would like to see that. I am not finding fault with him because he does not say so. The fault I find is that you fellows who come in here make a contention on an indefinite thing of that kind and say he is going to spend $250,000 a year on a research proposition, and there is not any place where you are even morally obligated to do it, let alone legally and technically, under your contract, and you won't do it.

Mr. WALDO. I don't think that question has been raised as to the exact amount of money to be spent in research work. He agrees to establish a commercial research laboratory. Knowing how he does things, I say that his laboratory will replace the Government's, and will save the Government the $250,000 per year that it is now spending for this purpose.

The CHAIRMAN. This is another time we get back to this uncertainty. Nobody knows how much we ought to spend. It may be that when the thing gets started to going $10,000 will be ample and sufficient, and maybe it will take $500,000. Nobody knows now.

Mr. WALDO. If you would get the director of the fixed nitrogen research laboratory, Doctor Tolman, here to pass on that paragraph I believe he would be glad to tell you that in his opinion an honest carrying out of that proposition in accordance with the spirit and purpose and intention of this contract would call for as much money as he has spent, and $250,000 per year is what he has spent.

The CHAIRMAN. That may be true to-day, and in 10 years from now it may take ten times that or one-tenth as much.

Mr. WALDO. But all the drift of development in scientific research along any line is toward the more complex, more complicated. It is not that we find that there is less to develop, but on the contrary, as one well-known scientist said, "I feel that I have been playing with a few grains of sand on a whole seashore of possibility." That is where we are. We have hardly begun to investigate those things as yet. We are merely kindergarten babes in this thing.

The CHAIRMAN. Oh, yes. I wish we had done more. I wish we were doing more now, and I think we ought to, and we are going to, in my judgment; but the fellow who finally discovers a cheap process, it may be by some method that won't cost 25 cents.

Mr. WALDO. To be sure. It has sometimes been true that those things have been stumbled upon in an entirely accidental way. But to-day you do not find that the successful inventor accidentally stumbles onto those things. Take the development of radio, for instance. Was that an accident that they discovered the audion tube? Yes, in a way, but it was an accident that happened to a man who had been investigating and who had surrounded himself with conditions whereby such a combination of circumstances could come about.

I think that is all, Senator.

The CHAIRMAN. All right, Mr. Waldo. I have been greatly interested in your testimony.

Senator HEFLIN. Mr. Waldo, just one question before you go.

You are convinced that Mr. Ford will make fertilizers in abundance at Muscle Shoals?

Mr. WALDO. Absolutely.

Senator HEFLIN. And that he will sell fertilizers to the farmer at a price very much cheaper than he has to pay for them to-day?

Mr. WALDO. Yes, sir. I think he can do it even if his costs per unit of plant food at that plant are no lower than those of other manufacturers, simply because of the saving in distribution of the concentrated material.

Senator HEFLIN. I feel that more people will be blessed and benefitted by accepting the Ford offer than any other disposition that can be made of Mucsle Shoals. Is that your idea?

Mr. WALDO. Beyond question, and if you try to distribute the benefit over an electric wire, then you are distinctly limited in your area over which the benefit can be had as compared with distributing cheap and high grade fertilizers.

Senator HEFLIN. That is all.

The CHAIRMAN. We would be justified, then, I suppose, on the answer you gave to Senator Heflin, to announce on the floor of the Senate and to the people that if Ford gets this proposition the farmers will get fertilizer at one-half the present cost?

Mr. WALDO. I would call your attention to the fact, Senator, that in 1912 Mr. Frank brought it over to this country, testified to this committee that fertilizers could be

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S. Washburn, the man who went abroad and obtained the cyanamide process and produced at about one-half of what the farmer would otherwise pay for them if the cyanamide process were installed at Muscle Shoals.

The CHAIRMAN. What connection has that with the Ford offer?

Mr. WALDO. Because it is the same plan and the same process applied under favorable circumstances.

The CHAIRMAN. Suppose the bill that I have introduced and that is now pending before the committee was passed and a governmental corporation were organized that did not want to make 8 per cent on fertilizer. Could they do the same thing?

Mr. WALDO. If you can get anything like an approach to the efficiency in a Government corporation that you can in the Ford organization, that is absolutely so, Senator.

The CHAIRMAN. Then this cheapening of the fertilizer proposition is not confined to Mr. Ford alone, is it?

Mr. WALDO. It is fundamentally based on the efficiency that you can get in a commercial operation.

The CHAIRMAN. What reason have you to think that this corporation which Mr. Ford will organize, after Ford dies, say 10 years from now, will be any more efficient than J. P. Morgan's corporation or John D. Rockefeller's corporation?

Mr. WALDO. Because I have a very healthy confidence in the intelligence of the farmers of this country, that when you put a thing like that in their hands, and they have some real reason for maintaining their organizations to protect their interests.

The CHAIRMAN. If Morgan had it it would be in their hands just the same, wouldn't it? What is the difference?

Mr. WALDO. But the policy of Wall Street is entirely different and apart from such a policy as this. Wall Street has not appeared with such an offer.

The CHAIRMAN. Entirely different from Mr. Ford's now. I agree with that. But I am asking you about this corporation after Mr. Ford is dead. How will it differ from Morgan's corporation or Rockefeller's corporation or the International Harvester Corporation?

Mr. WALDO. In all these United States, with the education and knowledge that there is on the part of the farmers of the country, if there can not be found seven men out of a total of nine who can administer a problem like that in the interest of all the farmers no matter whose the corporation is, then I say it is hopeless.

The CHAIRMAN. Yes. All right, let us take it that way. But who will be these seven out of nine men? Seven men that Morgan controls may be running it.

Mr. WALDO. If Mr. Morgan can get an appointment on a board like that——

The CHAIRMAN. Suppose Morgan owns the stock of the corporation. If Ford is dead, now, and the corporation that he has organized has got this. What difference is that corporation from any other corporation owned or operated by anybody else for profit or for money? I am not saying that any of them would be wrong, but I want to see that they get cheap fertilizer just the same when Ford is dead as they would if he was alive. What difference does it make on the fertilizer end of it, when Ford is dead and this corporation is like every other corporation? Where is the difference?

Mr. WALDO. The policy is fixed in the contract and the board that is set up maintains that policy regardless of how long Mr. Ford lives. You assume that his fortune will be dissipated and he will have to sell out.

The CHAIRMAN. No; it does not assume anything of the kind. It just assumes that the law of human nature will be in operation after Ford is dead the same as it is now; that when Ford is dead he will not have anything to say about it. That is as far as the assumption goes.

Mr. WALDO. All right. The policy is fixed and maintained independently of the length of Mr. Ford's life.

Senator HEFLIN. Mr. Waldo, you remember that Benjamin Franklin, who established the Saturday Evening Post, provided in his will that the paper should be sold on and on and on for 5 cents a copy, and it has been done ever since.

Mr. WALDO. That is true.

Senator HEFLIN. Mr. Ford could provide in his will instructions how that plant should be run, could he not?

Mr. WALDO. Undoubtedly.

The CHAIRMAN. Now, let me ask you a question about his will. Mr. Ford could also provide in his will, could he not, that on his death all the stock in this corporation should be turned over to the National Harvester Co.?

Mr. WALDO. Mr. Ford would hardly do a thing like that, but if he did the terms would still be fixed.

The CHAIRMAN. Exactly, but now there is where you come upon another uncertainty.

Mr. WALDO. But we are dealing with Mr. Ford now.

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The CHAIRMAN. Of course we are dealing with Mr. Ford now, but Senator Heflin was asking you could he not do a certain thing, and you answered him that he could, and I am asking could he not turn it over to the devil, if he wanted to. Why are you so absolutely biased, you fellows, as to say when Ford is dead this thing is going on just as though Ford was alive, when you know better?

Senator HEFLIN. You could have said that same thing when Ben Franklin died.

The CHAIRMAN. You must know better. Do you think this corporation is going to be a Sunday-school proposition for a hundred years?

Mr. WALDO. No, sir. It is a definite contract, not simply a moral obligation.

The CHAIRMAN. It may be, I concede it now, but there is not any guarantee in this contract that it will be for 5 minutes after Ford is dead, and you won't put anything in the contract about that. You won't agree in writing even that Mr. Ford shall do so and so. Mr. Ford can turn around and make this fertilizer and sell it for nothing until his millions have been exhausted for the farmer, but he does not agree to do it.

Mr. WALDO. But he has agreed to limit his profits on the proposition.

The CHAIRMAN. To 8 per cent. Great God, if I had made 8 per cent on everything I did I would be a millionaire myself now.

Mr. WALDO. He considers 8 per cent a fair manufacturing profit, that is all.

The CHAIRMAN. I am not complaining about that, even if he made 10 per cent if he cheapened the product to the farmer. He made a good deal more than 8 per cent when he made automobiles, and he made automobiles cheap, and kept the price down, and did a great thing by it, but when you talk, and Senator Heflin talks, as you do continuously, about what is going to happen after Mr. Ford is dead, if you would brush away the cobwebs of prejudice for one moment you would know you are talking through your hat.

Mr. WALDO. Senator, I don't ask you to go one inch beyond this contract.

The CHAIRMAN. And I don't intend to. I would not have mentioned that if you had not put in those things that you did put in, and that you are putting in, you fellows that are spreading propaganda here.

Mr. WALDO. What, for example?

The CHAIRMAN. That you are going to sell fertilizer for one-half the present price.

Mr. WALDO. That is a reasonable expectation because that is the conclusion of experts who have studied the subject and who know the facts.

The CHAIRMAN. That is not peculiar to Ford's proposition at all, and there is no guaranty that Ford will do it, but Senator Heflin keeps repeating it, that Ford intends to cut the price in two.

Mr. WALDO. That is the reasonable expectation.

The CHAIRMAN. All right. Tell them that. Tell them, "We expect to do it, but we don't know." You tell them Ford is going to do it, but if he does it will be because of some new invention that comes along, which everybody hopes and prays will come along, but it has not so far.

Senator HEFLIN. The Wright boys said they were going to build a machine and fly in the air, and everybody said they couldn't do it, but they did.

Mr. WALDO. Senator, you have mentioned some propaganda on the part of the farmers in connection with this thing. I have one of the circulars, and I want to read to you what they are representing about this thing. They don't go out and say what you say they do. They do not say positively that he can cut the price of fertilizer. They use this language:

"A reasonable expectation from such a development would be the cutting of the farmer's cost of commercial fertilizer in half. Such a result would save the farmer $100,000,000 a year and provide a lower cost factor in the production of food and clothing."

And, Senator, I don't want to leave you with the impression that the Tennessee River Improvement Association is endeavoring to read into the Ford proposal things that are not there. We are simply examining this thing from a reasonable standpoint. There will be things happen that none of us can foretell. But, as we all agree, under no plan that calls for a 100-year operation, on any project, can you tell what the results are going to be in the course of the years. Neither could you in a 50-year plan nor a 20-year plan nor a 10-year plan.

The CHAIRMAN. No, you couldn't; and the longer you make the term the greater the uncertainty, and the more careful we should be in entering into any arrangement. Congress fixed the time at 50 years because they had to fix some time, and that was a compromise. You can not go anywhere, under the Federal law, and build a dam on a navigable stream and get a lease longer than 50 years. The theory is, of all conservationists, that we ought not to give away these rights that we think belong to all the people of the United States, on such a long term that it is beyond human ingenuity to conceive, that it is beyond the power of the human mind to imagine what condition

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will exist. Such strides have been made in invention in our lifetime, Mr. Waldo, in the last five years, that you are living in a different world every week, almost, and what is going to happen in the matter of fertilizer or water power or electricity in a hundred years from now is so uncertain that nobody knows what it is. We all believe they are going to be greatly improved, and I dont' want to take any step that will foreclose unborn generations in whatever rights they may want to assert.

Mr. WALDO. But we do know, from the record, from 1896 to 1920 the Federal Government has spent over $700,000,000 for the improvement of its navigable streams, and never got a cent.

The CHAIRMAN. Most of it thrown away.

Mr. WALDO. Yes, sir. I agree with you.

The CHAIRMAN. Yes, sir; I think so.

Mr. WALDO. We all agree if they accept the Ford proposal we will have a water power developed, and one in which 4 per cent is guaranteed to the Government for all that time, whatever may be the reduction in the value of the property, or whatever may be the commercial vicissitudes.

The CHAIRMAN. But that is no answer to the uncertainty.

Senator HEFLIN. You feel the best way to serve the next generation is to begin with this one, don't you?

Mr. WALDO. Yes, sir; and substitute a certainty for an uncertainty.

Senator HEFLIN. You think Mr. Ford can take that water that is going to waste and serve more people than any of these companies or people that are fighting him in getting this project?

Mr. WALDO. The record shows we can not certainly expect anything of that sort from them.

Senator HEFLIN. You realize that the power companies and fertilizer companies are all fighting him, don't you?

Mr. WALDO. There is no question about that. They are out in the open on it.

Senator HEFLIN. They have had several witnesses before this committee that have fought it. Some of them admitted they didn't want him as a competitor.

The CHAIRMAN. Now, Mr. Heflin, that is very unfair. I have no particular friendship for the fertilizer people, but that is perfectly natural, and they never went further than that. It is perfectly natural that any man in the business wants to prevent competition if he can.

Mr. WALDO. If he has been doing his duty as a business man, then I have not a word to say, but the fertilizer business is right where it was 50 years ago, Senator. They are employing those same old methods that they used then.

The CHAIRMAN. All right. I don't care anything about them, as far as the Ford proposition is concerned. I have nothing to do with them. I don't care anything about them. But I don't want to mispresent them, even though I have no friendship for them.

Mr. WALDO. Neither do I, for a moment.

The CHAIRMAN. And the cry made all the time about the great combination. I want to make a proposition right now to Senator Heflin who is continually saying there is a fertilizer trust—and I am not denying it, but if there is, for God's sake let us prove it in the regular way. Give me the names of the witnesses, and I will send for any one of them, and you can cross-examine them. That is the way to do it.

Senator HEFLIN. Let the Attorney General get after them. I am simply saying here what the testimony has disclosed. I have asked witnesses myself.

The CHAIRMAN. Senator, the witness who is the head of it, if there is such a thing, was here, and you sat right here and never asked him a question.

Senator HEFLIN. I don't know about that, but I remember one or two questions, and he testified that he went from California to Muscle Shoals at his own expense.

The CHAIRMAN. No. He testified that the California commission paid his expense, and I tried to show from his testimony that that was unfair, that they had no right to do it, and that the consumers of electricity out in California had to pay for it.

Senator HEFLIN. That shows a combination fighting Ford.

The CHAIRMAN. I think it is an outrage, myself. The man who is at the head of this supposed fertilizer trust I examined in every way I knew how to throw light on the matter as to whether there was a fertilizer trust. He testified that if there was a fertilizer trust he was the head of that trust.

Senator HEFLIN. Mr. Chairman, you wouldn't expect him to admit that he had a trust?

The CHAIRMAN. Certainly not; but I tried to examine him to show just what those things were and Senator Heflin sat there, and I supposed with all his ability and his knowledge about the fertilizer trust he would be able to put questions to him that would put him in a hole and show there was a trust, but he didn't do it.

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Senator HEFLIN. I don't remember this particular witness, but if I did not question him any I didn't believe what he was saying, and I didn't want to have anything to do with his testimony.

The CHAIRMAN. Well, now, Senator, when we examine a witness on the witness stand that we believe is not telling the truth, that is the time we go after them on cross-examination.

Senator HEFLIN. Why did I want to fill up the record and take up the time to ask him any questions, the man who is supposed to be the head of the trust, whether he has got a trust or not?

The CHAIRMAN. No, but when you get that man on the stand that is the place to learn everything about the trust.

Senator HEFLIN. But all the farmers of the country that have been held up year after year by this combination know, and to illustrate the point:

"The toad beneath the harrow knows
Precisely where the tooth point goes;
But the butterfly along the road
Preaches contentment to that toad."

The CHAIRMAN. Do you mean to insinuate that I am the butterfly, now, and you are the toad?

Senator HEFLIN. Not at all, but the farmer is the toad, and these other fellows are running the harrow down there, and they are getting it in the back, and the toad is groaning, but the butterfly flits around and says, "You ought not to complain; it's a nice day."

The CHAIRMAN. When this butterfly came on the witness stand and Senator Heflin sat down there and did not ask him a single question all the time he was testifying they will begin to wonder what is the matter.

Senator HEFLIN. If I did not cross-examine him at all they will know what the reason was.

Mr. WALDO. There is what is known as the National Fertilizer Association, with headquarters in Philadelphia, and they have been sending out a series of colored circulars attacking this whole plan, to the Members of Congress. And there have been many others.

The CHAIRMAN. All right, and it may be that some of them have come to me. I have not read one in twenty of what has come to me. I have said to Senator Heflin, and I make the same proposition to you now, let us get the witnesses here and go into this Fertilizer Trust question. You give me the names of the witnesses that will prove it, or may be you have the knowledge. If so, tell us about it.

Mr. WALDO. I will be very glad to supply the literature we have on the opposition to this thing, but it does not prove that there is a fertilizer trust. In my opinion, whether there is or not is beside the point entirely.

The CHAIRMAN. I think so myself, but we are hearing it continually asserted. I would like to have it proved.

Mr. WALDO. I have never so stated.

The CHAIRMAN. Oh, haven't you?

Mr. WALDO. No, sir. I have said the fertilizer people were against this thing, but whether they have what can be called a fertilizer trust or not is another matter. But that does not make any difference. They get the same results as if they did have a trust.

The CHAIRMAN. I don't think it matters whether there is a fertilizer trust or not. If we can cheapen fertilizer, we ought to do it.

Senator HEFLIN. You will find in Senator Butler's printed testimony, my recollection is, that he talked about the Fertilizer Trust, and how it would help to relieve the farmers even if they accepted his bid. A number of the witnesses that I questioned, I said something about relieving them from the Fertilizer Trust, and they said, "Yes, that is right." Nobody ever disputed that they had a trust.

The CHAIRMAN. When you ask a witness a question "Would you like to be relieved from the Fertilizer Trust and get your fertilizer at one-half the price?" then you assume you have proved there is a Fertilizer Trust.

Senator HEFLIN. If there was no trust I would expect him to say, "There is no Fertilizer Trust, but I would like to get fertilizer cheaper."

The CHAIRMAN. He is speaking about getting fertilizer cheaper, and he says, "Yes, I would like to get it cheaper."

Senator HEFLIN. The main thing we have here is to dispose of Muscle Shoals to the best advantage, in a way that would serve the most people. Of course I would love to have this trust investigated, but I don't see that that is a very important point in determining whether we accept Ford's offer or not.

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The CHAIRMAN. If there is a fertilizer trust that is increasing the price of fertilizer to the farmer, we ought to bring out the evidence and demand their prosecution and send them to jail.

Mr. WALDO. What we have in mind, Senator, is not a matter calling for prosecutions at all. It is simply that we have a set of economic conditions that are such that we are paying more for fertilizer than is necessary.

The CHAIRMAN. That may all be true, Mr. Waldo, but it is continually being charged here, "Why, the Fertilizer Trust has got the farmers in its grip, and we have got to do something down there in order to change it." I think the evidence demonstrates here—and I am sorry it does not demonstrate to the contrary—that under all known conditions and processes now known by scientific men we can not, even at nitrate plant No. 2, cheapen the cost of fertilizer without new or improved methods being discovered, and my only hope lies in new discovery. I think it has got to come before we can get a material reduction.

Senator HEFLIN. Mr. Ford claims he has got that now.

The CHAIRMAN. Oh, no; Ford has not said that he has got that. That is what you say all the time.

Senator HEFLIN. The witnesses have so testified.

The CHAIRMAN. That is another thing you people are continuously harping on. You are leading the people to understand that Ford has a secret process by which he is going to cut the price of fertilizer in two, and there really is not any evidence that he has it.

Mr. WALDO. In my opinion it is not necessary to use any secret process whatever to accomplish the result you mention.

The CHAIRMAN. If you have a secret process that will cut the price of fertilizer in two and you won't use it, you are not even patriotic; and if you have a secret process and are still going to keep it secret and not utilize it, you ought to go to jail.

Mr. WALDO. How are you going to tell whether your secret process will do what you think it will do until you have an opportunity to try it out under commercial conditions and see whether it will or not?

The CHAIRMAN. You can't tell.

Mr. WALDO. Exactly, and we have never represented that the half-priced fertilizer was based on any secret process Mr. Ford may now have. But it is based on the fact that fertilizers are now being manufactured under present commercial methods, and in commercial forms that are well known to the trade, and everybody who is familiar with those things knows you can cut your price of fertilizer in half through distribution economies, using definite, well known methods. Mr. Swann testified with respect to one of those processes with respect to phosphoric acid. The Haber process for ammonia is another.

Senator HEFLIN. Didn't you hear Mr. Mayo's testimony?

Mr. WALDO. I certainly did.

Senator HEFLIN. Didn't he say Mr. Ford had a process by which he expected to do this?

Mr. WALDO. He did.

The CHAIRMAN. I can not conceive of the workings of a man's mind who will say that, or his representative. He does not say it himself. Somebody else comes here and says it for him, that he has a secret process by which he is going to reduce the cost of fertilizer and save the farmer, and he will use it if you will give him a contract for a hundred years by which he can make millions and millions every year, but he won't put it in writing. There is no agreement to that effect, but somebody told me that somebody else said that Ford told him that he had a process that would do it, and therefore we will give this to him without any agreement to that effect whatever. Now, that is what you are doing.

Mr. WALDO. He simply asks an opportunity to show what he can do, Senator.

Senator HEFLIN. He is willing to put in his money and go down there and try it.

The CHAIRMAN. Senator Heflin here is always saying, "Don't you understand Ford has a secret process," and Ford in your mind is pretty near a saint; and if he is and he has got that kind of a secret process and he does not tell the farmers, who are suffering beneath the load and in the clutches of this great fertilizer trust that has been so often pictured, he is a demon instead of a philanthropist, and instead of being given a favor he ought to be sent to jail for the balance of his life and ought to spend the remainder of time in purgatory.

Mr. WALDO. You are not quoting correctly either Mr. Ford or his representatives, Senator.

The CHAIRMAN. I am not quoting him at all, but that is the insinuation.

Mr. WALDO. Cheaper fertilizers are certainly a reasonable expectation under the Ford offer on the part of those who know what Mr. Ford has done in the past.

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The CHAIRMAN. What would you say to me if I said, "Give me two or three hundred million dollars on the possibility that I will be able to make fertilizer at one-tenth the present cost"? And Ford says to give it to him—Ford does not say it; I will say that to his credit—but Ford testifies that they think that might happen, and then Senator Heflin says, "Well, it is proven in the testimony here that Ford would cut that price down one-half." Would you give it to me, take my word for it if I told you that, and would you let me have this great snap because I have told some people that I am going to cut it down lower than he does? We haven't any assurance that anybody will cut it down. Let us face the truth. I believe if Ford gets it he will cut it down, and I think if this bill passes and we get our scientific men at work, they will cut it down. I believe that if anybody gets it improvement will come about by which they can cut it down. I have just as much faith in cutting it down as anybody has, and just as much interest, but, my good heavens, Henry Ford is not the only source to heaven. There may be other ways of getting there, and he doesn't know anything more about it than anybody else.

Senator HEFLIN. I have in mind a man cutting wheat with a single scythe. Another man comes along and says, "I am going to invent a mowing machine that will cut that wheat all in one day. It takes now a number of men with one scythe, working all day, to cut that field." They say he can not do it. But he has made this machine that cuts the wheat from this field. The man just sits up there and rides up and down that field, and he cuts the whole field in a day. Suppose you get the fellow that said they could not improve it.

The CHAIRMAN. But that fellow did not say, "Give me a hundred million dollars."

Mr. WALDO. Neither does Mr. Ford.

Senator HEFLIN. Ford says, "I will take that plant and make fertilizer and sell it at half the cost. I can do it. I have seen the other process. I will improve on it."

The CHAIRMAN. Why doesn't he go on and do it on his own responsibility? Why not go out and take a dam at some other place on the Tennessee River? There are hundreds of other places. Why has he not done it in Detroit, if he wants to do it?

Senator HEFLIN. The idea is suggested that he has a process. He won't do that, because he won't give it to the other fellow. He is waiting to get hold of this thing. That would be ridiculous.

The CHAIRMAN. Why not give it to the country? A man of his intelligence and means, if he had such a secret as that, would give it to them without any quibbling.

Mr. WALDO. If he knew what it would do, Senator.

The CHAIRMAN. Of course. That is the secret of it.

Mr. WALDO. Mr. Ford is in position where he gets scores of inventions brought to him every day, but we believe he can cut the price of fertilizer in half by means that are well known to science to-day.

The CHAIRMAN. Why doesn't he do it? He doesn't have to have Muscle Shoals to do it. Why does he want Muscle Shoals? Is there anything attractive there?

Mr. WALDO. The necessary conditions are there, Senator.

The CHAIRMAN. He is getting from the Government what cost them over $100,000,000 for $5,000,000.

Senator HEFLIN. If he does get it we will take the chairman of the committee down there and let him see what he is doing, and then he will be sorry that he stood in the way.

(Whereupon, at 1.30 o'clock p. m., the committee adjourned subject to the call of the chairman.)

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MUSCLE SHOALS.

WEDNESDAY, JUNE 21, 1922.

UNITED STATES SENATE,
COMMITTEE ON AGRICULTURE AND FORESTRY,
Washington, D. C.

The committee met, pursuant to call, at 10.30 o'clock a. m., in room 224, Senate Office Building, Senator George W. Norris presiding.

Present: Senators Norris (chairman), Capper, Gooding, Ladd, Harreld, McKinley, Smith, Kendrick, Heflin, and Caraway.

The CHAIRMAN. The committee will come to order.

Before the witnesses proceed, I want to read into the record a communication which I have received as chairman of the committee, from the War Department.

(The chairman thereupon read the following letter, with its inclosure:)

WAR DEPARTMENT,
Washington, June 15, 1922.

HON. GEORGE W. NORRIS,
Chairman Agricultural Committee,
United States Senate, Washington, D. C.

MY DEAR SENATOR: I inclose herewith, for your information in connection with the question of disposing of the nitrate plants at Muscle Shoals, Ala., copy of a letter from the Air Nitrates Corporation which explains itself.

I feel that you should be informed of the stand taken by this corporation with reference to the opinion of the Attorney General on contract No. T-66, dated June 8, 1918.

Sincerely yours,

J. M. WAINWRIGHT,
The Assistant Secretary of War.

AIR NITRATES CORPORATION,
New York, June 1, 1922.

The honorable SECRETARY OF WAR,
Washington, D. C.

DEAR SIR: The Attorney General of the United States has rendered an opinion under date of May 25, 1922, to the effect that a certain contract, No. T-66, bearing date June 8, 1918, by and between the Air Nitrates Corporation and the United States, under which the Air Nitrates Corporation constructed and operated nitrate plant No. 2 at Muscle Shoals, Ala., during the war emergency, is invalid in so far as it grants to the Air Nitrates Corporation a prior right to purchase said plant in the event of a decision to sell said plant.

We hereby notify you that, in our opinion, the said preferential clause is a valid and binding obligation of the United States and, therefore, we intend to take such proceedings as may be necessary to protect our interests in the event that the proper governmental officers decide to dispose of said plant without regard to our legal rights.

Respectfully,

AIR NITRATES CORPORATION,
By J. O. HAMMITT, *Vice President.*

The CHAIRMAN. The members of the committee will remember that there were two contracts, one with the Alabama Power Co., by which an agreement was made to sell the interest of the Government in the Gorgas plant, and another contract was with the Air Nitrates Corporation, by which they agreed to give the Air Nitrates Corporation a preferential right to purchase nitrate plant No. 2 in case the Government decided to sell it. This letter, of course, bears directly on that proposition.

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I will read into the record also a communication from Colonel Cooper, who has already testified, and who was the consulting engineer in the construction of the dams.

Major BURNS. He was designing engineer and in control of construction.

The CHAIRMAN. Yes; and he has been in control of all that has been done on the dams.

Major BURNS. Practically all.

The CHAIRMAN. After he testified it occurred to me that there was one proposition involved in the consideration of this question that had not been touched upon much, scarcely touched upon at all by any of the witnesses, and I wrote a letter to Colonel Cooper, asking him to submit in writing his estimate, and so that the committee will understand the whole question I will read my letter directed to Mr. Cooper.

(The chairman thereupon read the letter referred to, as follows:)

WASHINGTON, D. C., *June 12, 1922.*

Col. HUGH L. COOPER,
101 Park Avenue, New York City.

MY DEAR COLONEL COOPER: I was anxious to get your estimate of the cost of maintenance of Dam No. 2 and Dam No. 3 at Muscle Shoals for a period of 100 years. Under Mr. Ford's offer he keeps in repair the power house, its substructure, superstructure, machinery, and appliances, but it is distinctly stated that the Government shall make all necessary repairs and do everything necessary for the maintenance of the dam proper as well as the locks. It is, of course, perfectly proper that the Government should keep the locks in repair because they will use them more than Mr. Ford, but under Mr. Ford's bid the Government is responsible for the maintenance of Dams 2 and 3 and the only contribution Mr. Ford makes is $35,000 annually during the period of lease of Dam 2 and $20,000 annually during the period of lease of Dam 3. I am very anxious to get your opinion as an expert as to the probable cost of the maintenance of these two dams during the 100-year period. Would this maintenance cost likely increase as time went on and the dams became older? Your early reply will be very much appreciated.

With best personal regards, I am,

Sincerely,

———— ————.

The CHAIRMAN. Here is Colonel Cooper's answer to that letter which I have not read myself, but which I will read now to the committee. It is directed to me.

(The chairman thereupon read the following communication:)

NEW YORK, *June 20, 1922.*

Hon. G. W. NORRIS,
Committee on Agriculture and Forestry, United States Senate, Washington, D. C.

DEAR SENATOR NORRIS: This will acknowledge receipt of your inquiry of June 12, regarding the sufficiency of Mr. Ford's proposed allowance for maintenance and operation of $35,000 annually during the period of lease of Dam No. 2, and $20,000 annually during the period of lease of Dam No. 3.

You have asked me for my opinion as an expert as to the sufficiency of the above two allowances for the yearly period of approximately 100 years, covered by the proposed lease to Mr. Ford.

Paragraph 4 of Mr. Ford's proposal contains the following:

"The company will further pay to the United States during the period of the lease of Dam No. 2, $35,000 annually, in installments quarterly in advance, for repairs, maintenance, and operation of Dam No. 2, its gates and locks; it being understood that all necessary repairs, maintenance, and operation thereof shall be under the direction, care, and responsibility of the United States during the said 100-year period."

Paragraph 8 of Mr. Ford's proposal uses the same language with respect to Dam No. 3, except that $20,000 is the annual payment.

In my recent testimony before your committee I was asked by either your good self or some member of your committee, as to the sufficiency of the above two sums of $35,000 and $20,000, respectively. I replied, as a rough estimate, not based upon any definite analyses of the subject, that the allowances were about one-half what they should be.

Since the receipt of your letter of June 12, I have composed the following analyses of the sufficiency of these two allowances, and beg to submit the same for your consideration, the analyses being made up in exactly the same way as I make up similar estimates for clients in private practice.

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The tables below are based upon the following assumptions:

(*a*) That masonry per se will require practically no renewals or maintenance disbursements, if it is properly put in in the first place.

(*b*) That all metal work, moving and stationary, will have to be renewed every 40 years.

Figuring the value of money at 4 per cent compounded annually, assumption (*b*) requires an amortization charge of 1.05 per cent against first cost, to be invested yearly to take care of renewals at the end of the 40-year period on the further assumption that the renewals at the end of the 40-year period can be made at the same cost as the original cost at the time the work was installed.

On the above basis the extimated cost of the operation and maintenance of the two locks for Dam No. 2 is as follows:

LABOR.

1 lock superintendent, per annum	$2,000
1 assistant lock superintendent, per annum	1,800
6 lock tenders (3 shifts, 8 hours each, 2 men per shift), at $1,200 per annum	7,200
3 engineers (1 per shift to operate both lock gate engines and engine on bascule bridge), at $1,400 per annum	4,200
3 engineers for compressor plant (1 per shift), at $1,200 per annum	3,600
Annual minor repairs and miscellaneous supplies, grease, oil, waste, electric light supplies, etc., including painting of 12 lock gates every third year	2,800
Annual repairs and painting of valves, cleaning lock chambers, and cofferdam placements incident thereto	3,000
Renewals at end of 40-year period, all metal work, initial cost of which will be $336,000, $336,000 at 1.05 per cent	3,528
Total charge against lock system	28,128

OPERATION AND MAINTENANCE OF DAM NO. 2.

1 superintendent, per annum	$1,800
6 men (2 per shift, 3 shifts), at $1,200 per annum	7,200
Annual repairs to 63 gates and their operating mechanisms, and incidental supplies thereto, including painting every 3 years	12,000
Amortization of all metal work on basis of 40-year life, $960,000 at 1.05 per cent.	10,080
Probable annual expense of apron renewals, and inevitable apron extensions at toe of dam	14,000
Annual minor repairs to masonry in bridge and overfall structure	3,000
Operation of barge, and amortization and maintenance thereof to handle driftwood, per annum	2,000
Total	50,080
Add annual cost of locks	28,128
Total maintenance and operation allowance that should be made for Dam No. 2 and its locks (excluding main power house)	78,208
Mr. Ford's allowance for this item	35,000
Discrepancy	43,208

The foregoing estimates of costs are as low as any experienced estimator would make them. In support of this statement attention is invited to the fact that at Keokuk, Iowa, a new modern lock with practically no traffic and with no trouble with its masonry and lock gates whatsoever and with no charge for amortization at the end of the 40-year period, has cost the Government of the United States for the last nine years an average annual cost for operation and maintenance of $17,829 for one lock only, as against two locks at Muscle Shoals, each of greater lift than at Keokuk. In my estimates I have allowed for the minimum operating staff that could be used with the idea that navigation on the Tennessee River will be very light for many years to come.

As to the sufficiency of the $20,000 allowance for the operation and maintenance costs of Dam No. 3 and its locks, I think you will be quite safe in assuming that the actual costs at Dam No. 3 will be that same percentage of the above costs detailed for Dam No. 2, as the operating head at Dam No. 3 is of the operating head at Dam No. 2. The normal operating head at Dam No. 2 is 94 feet. The normal operating head at Dam No. 3 is 38 feet, or slightly less than 40 per cent of the operating head

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at Dam No. 2. This percentage of 40 applied to the costs for Dam No. 2 gives us $31,283.20 as the estimated allowance for the maintenance and operation of Dam No. 3. This figure of $31,283.20 is to be compared to Mr. Ford's allowance of $20,000 for the same item.

My total estimated annual costs for Dams 2 and 3, with their locks, become as follows: Dam No. 2, $78,208; Dam No. 3, $31,283.20; total, $109,491.20.

Mr. Ford's allowance for these same items is $55,000, which is a ratio of practically 2 to 1.

NOTE.—With respect to the use of 40 per cent ratio for the cost of Dam No. 3, in the absence of definite plans for Dam No. 3, this 40 per cent ratio is probably as rational an assumption as can be made at this time.

You asked the question, "Would this maintenance cost likely increase as time went on, and the dams became older?"

The maintenance cost of the metal work would increase as time went on, but if the dams themselves are taken care of in the way the estimates above specified require, then the maintenance costs should never increase as time went on.

With reference to your statement, "It is, of course, perfectly proper that the Government should keep the locks in repair because they will use them more than Mr. Ford."

The only possible observation that I would make with respect to the view you have expressed is the one that Mr. Ford's proposal is so worded as to convey the idea that allowance of $35,000 per annum for Dam No. 2 is sufficient for the purposes he specified. The phraseology he uses is, therefore, again misleading, and as such is quite in harmony with his original proposal of July 8, 1921, in which he very adroitly says in paragraph 1, "6 per cent on the remaining cost of the locks, the dam and power-house facilities, taken at $20,000,000," and in paragraph 6, with reference to Dam No. 3, "6 per cent on the cost of the dam, lock, and power-house facilities, taken at a cost of $8,000,000."

The reader of the proposal of July 8, 1921, would conclude from the phraseology of Mr. Ford's letter that Dams Nos. 2 and 3 required but $28,000,000 to complete them as of July 8, 1921, when as a matter of fact the actual cost to complete these two structures can not be taken as less than $50,000,000.

Similarly, anyone reading paragraphs 4 and 8 of Mr. Ford's proposal as it is now before the Congress, would conclude that the cost of operation and maintenance for the two dams would be $55,000, when as a matter of fact, in actual experience, the cost to somebody would be at least the figures I herewith submit.

I regret exceedingly the delay that has occurred in replying to your inquiry of June 12, the same being caused by my absence from the office on the Pacific coast, from which absence I returned yesterday morning. If there is anything further I can do for you in this matter, or any other matter, either in the way of further reports or in the way of an interview with you in Washington, I should be very glad to respond. My present engagements are such that I will be here in New York or the immediate vicinity for the next 30 days.

I have been deeply impressed all along with your very earnest desire to get to the bottom of this whole vexed question, and to thereafter fearlessly compose a solution that would result in the greatest good to the greatest number of our people, and if there is any way in the world that I can aid you in the purposes I know you possess, I certainly am yours to command.

With much esteem, believe me,

Yours very truly,

HUGH L. COOPER.

Senator CARAWAY. May I ask a question, Mr. Chairman?

The CHAIRMAN. Yes.

Senator CARAWAY. It strikes me that his letter discloses one thing, where he wants to give us the impression that he is telling us something else, that practically the entire cost of maintaining has to do with the locks. It is conceded that Ford has nothing whatever to do with the locks.

The CHAIRMAN. Personally, I do not think Mr. Ford ought to keep the locks in repair, or anybody else.

Senator CARAWAY. This man was undertaking to give us the impression that this cost was the cost of maintaining the dam when, as a matter of fact, there is not anything about the dam, according to his own statement.

Senator SMITH. I notice there that he is speaking of metal work in connection with the dam. That would be the expense. So far as the dam itself is concerned, it would practically not require any annual expenditure, but as the Senator from Arkansas intimates, he has gotten the two things together in such a manner that we do not clearly see just what will be required with respect to the dams.

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Senator HARRELD. Let me ask a question. Maybe it will clear up the matter.

Senator SMITH. It seems to me if the locks are to be used by the Government and not by Mr. Ford, as the chairman here intimates, the Government should keep up the locks, and what we are interested in knowing is what will Mr. Ford use and what would be necessary for Mr. Ford to expend to get the use out of the property that he is to use.

Senator CARAWAY. And that was the very question that Colonel Cooper tried to cover up in his letter.

The CHAIRMAN. I think in Colonel Cooper's figures—I had never read them until I read them aloud to you—you will find that you will be able to determine or differentiate between the locks proper and the dams proper. It is a mistake to think, as the discussion seems to indicate, that there is no metal work in the dams proper. There is an immense amount of it. There are gates all the way across, are there not. Major Burns?

Major BURNS. Practically all the way across. Over the overflowed section of the dam.

The CHAIRMAN. I suggest that we do not discuss that now. That will be like all the other evidence.

Senator CARAWAY. All right.

Senator HARRELD. Let me ask a question, the answer to which may shed light on it. Is this cost of upkeep included in Mr. Ford's plan of amortization.

The CHAIRMAN. No. In Mr. Ford's proposition he agrees to keep in repair the machinery end of the dam. What is the technical designation of that, Major?

Major BURNS. Generating equipment, power house.

The CHAIRMAN. Yes. He agrees to keep that in repair, where the machinery is.

Senator SMITH. The power house?

The CHAIRMAN. The power house; yes. He agrees to keep that in repair, and the Government must keep in repair the balance of the dams, but Ford pays, in one case, $35,000 a year and in the other case $20,000 a year. Ford does not do it, but the Government, under his bid, would be the guarantor to do it, and would do it itself, and keep it in repair. What I was trying to get was the differentiation between the cost of the locks proper and the dam proper, to see whether that was a fair contribution. But there will be some more evidence on it. I have made the same inquiry of some other experts, and they will testify.

Senator HEFLIN. What is your opinion, Mr. Chairman, that Ford is to keep up Dams No. 2 and 3?

The CHAIRMAN. He pays the $35,000 in the case of one dam and $20,000 in the case of the other.

Senator SMITH. Just before you pass from the letter of Colonel Cooper, it seems Mr. Ford was not so far out of line, according to his own figures, because when you subtract the upkeep of the locks from the other it leaves about $55,000 that Mr. Ford proposes to spend in the upkeep of a dam that he himself will use.

Senator CARAWAY. Of course, in the Cooper letter he figures the cost of operation of the locks; not only the cost of upkeep, but the cost of operation.

The CHAIRMAN. We met particularly this morning under a prior understanding that the Alabama Power Co. wanted to be heard on the legal aspect particularly of their contract, and you may proceed, Mr. Martin.

ADDITIONAL STATEMENT OF MR. THOMAS W. MARTIN, PRESIDENT ALABAMA POWER CO.

Mr. MARTIN. Mr. Chairman, there are several points that I wish to bring to the attention of the committee in connection with this subject.

There was recently transmitted to the committee a letter by the Secretary of War stating, in substance, that the Alabama Power Co. had offered $2,500,000 for the Government's interest in the Warrior steam plant and the other facilities connected with that situation in which the Government had made an investment. That, of course, is correct, and we did make the offer to the Secretary of War to pay in cash $2,500,000 for the Government's interest, and we stand ready and willing to carry out the purchase of the Government's interest.

At a hearing before the House Military Affairs Committee Major Burns, representing the Ordnance Department, stated in substance that in his opinion the fair value of the Government's interest in those facilities was $3,000,000. The contract which we have with the Government provides, in substance, that the value of these facilities should be arrived at by arbitration. The Attorney General holds, in substance, that the Secretary of War had no power to agree to an arbitration of the value of these

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facilities. Waiving aside the legal authority involved for the moment, we expressed to the Secretary of War, and we now express to this committee, our desire to negotiate with the Government with a view of reconciling what differences there may be between our offer of $2,500,000 and $3,000,000, and we wish to make that statement to this committee and place it definitely upon the record, that we are prepared to negotiate with the Government on those figures.

The CHAIRMAN. You have very definite knowledge about the value of the Government's interest there and are probably in a better position to know definitely than Major Burns is. I would like to ask you now if it is your judgment that Major Burns's testimony is about right in the matter of the valuation of that plant.

Mr. MARTIN. Mr. Chairman, I could only express it is this way: It depends altogether on the assumptions you would make as to the cost of reproduction of properties of this kind and the level of prices that you used. We might assume the cost of reproduction to be 70 per cent, whereas another engineer will say that the trend of prices is downward and that the cost of reproduction should be 60 per cent or 50 per cent. Another engineer might say the cost of reproduction is probably stationary where it is, and having arrived at a figure of cost of reproduction, it is a question of taking off the accrued depreciation.

The CHAIRMAN. Now, Mr. Martin, the cost to the Government was over $4,000,000. In fact, it was nearly $5,000,000.

Mr. MARTIN. The facilities here involved about $4,750,000.

The CHAIRMAN. Yes; that is about it. I suppose it would be admitted on the one hand that it was built at a time when the cost was high and you could build it cheaper now.

Mr. MARTIN. Yes, sir.

The CHAIRMAN. But so far as depreciation is concerned, with the exception, perhaps, of the transmission line, which is comparatively a small part of the value, there has been really no depreciation, has there?

Mr. MARTIN. It has been maintained in the highest state of order and efficiency, but there is always, Mr. Chairman, accrued depreciation in any machinery.

Senator MCKINLEY. Ten per cent on boilers.

Mr. MARTIN. Ten per cent per annum; yes. You would probably arrive at some figure between 10 per cent and 15 per cent for the whole plant for depreciation.

The CHAIRMAN. Assuming the cost of reproduction is the same now as it was when it was produced, the depreciation would not exceed 10 per cent, would it?

Mr. MARTIN. Yes, sir. I think that accrued depreciation would range between 10 per cent and 15 per cent.

You would arrive at that figure, Mr. Chairman, depending upon judgment; $2,500,000 in some points of view and $3,000,000 is not an unfair figure from other points of view. I simply say that if the Government officials finally conclude that in their judgment $3,000,000 is the fair value, and nothing less, of course there is nothing else for us to do but to agree upon it, and if we do agree upon it, I believe the Public Service Commission will recognize that value for rate-making purposes, and we will be prepared to meet the Government's figures. I say that frankly, because I feel satisfied that there will be a reasonable desire by the Government officials and our company to get at a fair figure when this question is finally closed.

Senator HEFLIN. In other words, if the Government will not take two and a half million you will give three million?

Mr. MARTIN. If the Government insists upon $3,000,000 as the fair value, we will give them $3,000,000; yes, sir.

Senator HEFLIN. You haven't any doubt about what they are going to insist on, have you?

Mr. MARTIN. Yes, sir; I have; because I think we will be able to convince them that $3,000,000 is not the fair value.

Senator SMITH. Does it not amount to this: It doesn't make much difference to the Alabama Power Co., because you expect to use that for rate-making purposes, and expect to pass it on to the people?

Mr. MARTIN. Therefore the Government, I think, ought not and would not insist upon an unreasonable amount.

Senator SMITH. I say it does not make much difference to the Alabama Power Co., because they are going to make it or use it for a basis of making their charge.

Mr. MARTIN. Yes; it make a great deal of difference, because if the Government should demand $4,000,000 for it I am quite sure our commission would not recognize $4,000,000 as the value of the property.

The CHAIRMAN. Assuming that that is agreed to by your company and the Government, that the Government wants to sell it to you, in reaching the value you ought

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to, and would not the Government want to, bring the Alabama officials who have supervision over your rates into consultation? If they are convinced that $3,000,000 is a fair value it seems to me that it is. I am not an expert, but looking over the plant and the condition it is in, I think Major Burns has been very fair in his estimate. If the Alabama officials coming into the negotiations now would consent, as the Senator from Arkansas says, it would not be very material to your company, if they would consent, and I agree with you, too, that the Government ought not to require a valuation there that would be so great that the people, who have in the end to pay the bills, could not afford to do it. They ought to be fair with you.

Mr. MARTIN. There is a point of balance, Mr. Chairman, that you well express, and the Senator from Arkansas has referred to, and we have had to bear that in mind, because as a public institution, as we are, we have to look at it from all these points of view.

Senator HEFLIN. Of course the money invested in the cost of production of power and light you have to figure on, and you are entitled to figure on it.

The CHAIRMAN. Yes; that is perfectly proper, and, on the other hand, if they got it at a very much reduced price they could be held and ought to be held to reduce their cost to the consumer correspondingly. If they get a bargain out of it, the people who buy electricity ought to get the benefit of it.

Mr. MARTIN. So I believe, Mr. Chairman, that the question is one that can be solved within reasonable limits on both sides.

I want to bring up next this question:

In earlier discussions of this contract the statement was made that the authorities dealing for the Government in its making violated section 124 of the national defense act in that that act laid certain restrictions upon creating properties intended to be operated jointly with private institutions. The Attorney General has gone into that question and overruled the Judge Advocate General completely and holds that section 124 of the national defense act has nothing to do with this question; that the authority under which the construction was done was not section 124 of the national defense act, but that the authority is in other acts referred to, the Attorney General using this language:

"* * * In the first place, the nitrate plants were built not under the $20,000,000 appropriation above mentioned, but under entirely different appropriations made to meet the war emergency, the contract not being in fact signed and delivered until November, 1918. And in the second place, the facilities just mentioned were brought into existence merely to furnish electrical energy, so that the plants might be operated. In no just sense, therefore, can it be said that the furnishing of electrical power to run these plants was an operation prohibited by the national defense act."

The Attorney General further held in effect that the power and authority to deal with this property—that is, to sell it, or sell the Government's interest—was, by virtue of the act of July 9, 1918, conferred upon the President, acting through the head of any of the departments, and that power still exists to deal with it. Therefore it comes right back to this, that the power which was vested in the Secretary of War by the President is still vested in the Secretary of War, and, if the Attorney General is correct in that the Secretary, through his department, did not properly exercise this power by this contract, we say that the power still exists in the Secretary to be exercised.

When this subject was referred to the House and Senate by the Secretary of War, it was referred upon the assumption that the Congress would have to pass enabling legislation to get away from section 124 of the national defense act. We have always considered that was an error, a legal mistake. The Attorney General sustains us completely, and I would like to put into the record at this point certain orders of the President out of which arose this possible confusion. It grew out of the fact that in the fall of 1917 the Secretary of War concluded that the Government did not have the power or authority to purchase lands under the then existing laws, for the nitrate plant. He requested the President to allot a certain amount of money from section 124 of the national defense act appropriation for this purpose. The President made the allotment by an order dated November 23, 1917. He increased it by an order of March 8, 1918. In the meantime there was passed an act of April 11, 1918, which, among other things, enabled the Government to acquire lands "For the construction and operation of plants for the production of nitrates and other compounds and the manufacture of explosives and other munitions of war, and for the development and transmission of power for the operation of such plants."

Senator CARAWAY. May I ask a question there?

Mr. MARTIN. I think I ought to conclude this point, Senator Caraway.

Senator CARAWAY. Under which authority was this property acquired? Under the power given to the President in the special appropriation, or was it under the act of Congress of 1918?

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Mr. MARTIN. That is what I want to tell you.

Following the passage of the act of April 11, 1918, Colonel Joyes testified that before it came to the payment for the first parcel of land or any parcel of land at nitrate plant No. 2, this act of April 11, 1918, was passed, and the Judge Advocate General considered that act authorized moneys appropriated by general appropriation acts to be used for the purchase of necessary land for the producing of munitions of war and the building of nitrate plants, and thereupon the President made an order completely revoking the orders previously made which had made allotments for the purchase of lands for that purpose.

Senator CARAWAY. Was none paid for out of that fund?

Mr. MARTIN. None at all. Not a dollar. On the contrary, Colonel Joyes testified that the lands were purchased and paid for following this act of April 11, 1918, from general appropriation acts. He further testified that the Warrior extension and all of those facilities were paid for completely from appropriation acts and in fact, Senator, there never was any order made by the President authorizing any part of section 124 funds to be used in connection with the Warrior matter. There was $340,000 authorized to be used in connection only with the purchase of lands for the nitrate plants, by the President, nitrate plant No. 2, which, as I stated, the President revoked.

Senator CARAWAY. Now, let me ask you, did the work proceed, however, under section 124 of the national defense act, or under the general appropriation?

Mr. MARTIN. Under the general appropriation acts, the lands being paid for from those acts under authority of the act of April 11, 1918.

Senator CARAWAY. That is where you state it was paid for; but it was authorized under the power of the President contained in the national defense act, or was it under the act of Congress?

Mr. MARTIN. Under the acts of Congress I have mentioned.

Senator CARAWAY. Wasn't it already in being before that time?

Mr. MARTIN. Nitrate plant No. 1 did proceed under section 124 of the national defense act.

Senator CARAWAY. But nitrate plant No. 2—was not that authorized before the act of Congress?

Mr. MARTIN. All of the funds for nitrate plant No. 2——

Senator CARAWAY. Not the funds. I am talking about the act of the Government in determining to construct the property. That was before the act of Congress.

Mr. MARTIN. According to Colonel Joyes, he proceeded under the general appropriation act.

The CHAIRMAN. I don't think you understand Senator Caraway's question. He wants to know where the authorization came from to begin this operation?

Senator CARAWAY. Yes. When did the Government determine to construct the plants and operate them? That was before the act of Congress of April 11, 1918? Major Burns, can you answer that?

Major BURNS. That was an ammunition plant, nitrate plant No. 2, and it was started in conformity with the money appropriated under the Army fortifications bill, the Army fortifications act passed in 1917.

Senator CARAWAY. The thing that I had in mind, Major, was that the determination of the Government to construct these plants as nitrate plants originated before the act of Congress of April 11, 1918.

Major BURNS. Yes, sir.

Mr. MARTIN. Mr. Chairman, I will hand to the stenographer the orders to which I have referred, if you wish to have them in the record.

The CHAIRMAN. Does any member of the committee want these orders in the record?

Senator HEFLIN. I suppose we had better let him put them in.

The CHAIRMAN. All right. I have no objection to it. I do not care for them, so far as I am concerned.

Mr. MARTIN. These are copies of the original orders and, as stated, the Attorney General concluded that the Warrior situation was not governed in any way by section 124 of the national defense act.

Colonel Joyes testified that this section, together with the statutes requiring written approval of the title by the Attorney General and cession of jurisdiction by the State, were held to be restrictions upon this general power of the Government to purchase land, and that all of these restrictions led to consideration of just what means could be taken for the purchase of the land necessary for nitrate plant No. 2.

Thereupon the Secretary of War requested the President to allot funds from the appropriation made by section 124 of the national defense act with which to purchase land for the nitrate plant No. 2, which request is as follows:

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WAR DEPARTMENT, *November 23, 1917.*

DEAR MR. PRESIDENT: 1. I have the honor to recommend that $200,000 be allotted to the War Department out of the $20,000,000 appropriated by section 124 of the national defense act, approved June 3, 1916, for the purpose of purchasing a site for an ammonium nitrate factory to be constructed and operated under appropriations for the procurement of explosives for military purposes, under control of the Ordnance Department, United States Army.

2. It having become apparent that a lage quantity of ammonium nitrate will be urgently needed for the conduct of the war during the ensuing year and thereafter, arrangements have been made for the construction and operation of a plant for such manufacture, the expense of such construction and operation being properly chargeable to appropriations for procuring explosives. But the procurement of the site for such factory is not properly chargeable to such appropriations.

3. As the product of the plant in question will be strictly within the description, "Nitrates or other products needed for munitions of war and useful in the manufacture of fertilizers and other useful products," as used in section 124 of the act approved June 3, 1916, which further specifically authorizes the acquisition of land for the production of such materials, the allotment of the funds as asked is manifestly proper.

Very sincerely,

NEWTON D. BAKER,
Secretary of War.

The PRESIDENT.

Approved:

WOODROW WILSON, *President.*

NOVEMBER 22, 1917.

It will be noted that the $200,000 requested was for the purpose of purchasing a "site" for the nitrate factory, which, however, was "to be constructed and operated under appropriations for the procurement of explosives for military purposes, under control of the Ordnance Department, United States Army." Subsequently a further allotment of $150,000 was made, as follows:

MARCH 8, 1918.

MY DEAR MR. PRESIDENT: Under date of November 22, 1917, you approved an allotment of $200,000 out of the appropriation of $20,000,000 provided in section 124 of the national defense act approved June 3, 1916, for the purpose of purchasing a site for an ammonium nitrate factory, known as United States nitrate plant No. 2. The Acting Chief of Ordnance now requests that an additional allotment of $150,000 be made, under this appropriation, for the purchase of additional land, it having been found necessary to purchase a larger piece of land for this plant than was originally contemplated on account of the topography of the site, the relation of the plant to the railroad, and to reduce to a minimum the effect of unavoidable dust from the plant on adjacent property.

The Acting Chief of Ordnance also requests that $250,000 be alloted from the same appropriation for the purchase of a site for the erection of an additional nitrate plant to be known as United States nitrate plant No. 3.

The appropriation of $20,000,000 above referred to is the only appropriation applicable for the purchase of land for United States nitrate plants.

Very respectfully,

BENEDICT CROWELL,
Acting Secretary of War.

The PRESIDENT,
White House, March 12, 1918.

Approved and authorized.

WOODROW WILSON.

An act had been passed July 2, 1917 (40 Stat. L. p. 241), authorizing condemnation proceedings to acquire lands for certain military purposes, but Colonel Joyes testified (hearings, 1050) that this act was so construed that no authority was conferred to acquire land for the nitrate plant, and this authority remained unchanged until the act of April 11, 1918, which amended the act of July 2, 1917, by adding the words: "For the construction and operation of plants for the production of nitrates and other compounds and the manufacture of explosives and other munitions of war and for the development and transmission of power for the operation of such plants," causing the act to read as follows:

"That the Secretary of War may cause proceedings to be instituted in the name of the United States, in any court having jurisdiction of such proceedings for the acquirement by condemnation of any land, temporary use thereof or other interest therein,

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or right pertaining thereto, needed for the site, location, construction, or prosecution of works for fortifications, coast defenses, military training camps, and for the construction and operation of plants for the production of nitrate and other compounds and the manufacture of explosives and other munitions of war and for the development and transmission of power for the operations of such plants; such proceedings to be prosecuted in accordance with the laws relating to suits for the condemnation of property of the States wherein the proceedings may be instituted: *Provided*, That when the owner of such land, interest, or rights pertaining thereto shall fix a price for the same, which in the opinion of the Secretary of War shall be reasonable, he may purchase or enter into a contract for the use of the same at such price and without further delay: *Provided further*, That the Secretary of War is hereby authorized to accept on behalf of the United States donations of land and the interest and rights pertaining thereto required for the above mentioned purposes: *And provided further*, That when such property is acquired in time of war, or the imminence thereof, upon the filing of the petition for the condemnation of any land, temporary use thereof or other interest therein or right pertaining thereto to be acquired for any of the purposes aforesaid, immediate possession thereof may be taken to the extent of the interest to be acquired and the lands may be occupied and used for military purpose and the provision of section 355 of the Revised Statutes, providing that no public money shall be expended upon such land until the written opinion of the Attorney General shall be had in favor of the validity of the title, nor until the consent of the legislature of the State in which the land is located has been given, shall be, and the same are hereby, suspended during the period of the existing emergency." (Federal Statutes Annotated, second edition, 1918, Supplement, p. 166.)

Colonel Joyce testified (p. 1055 of hearings) that before it came to the payment for the first parcel of land for nitrate plant No. 2 the act of April 11, 1918, referred to above, had been construed by the Judge Advocate General's Office to authorize moneys appropriated by the general appropriation acts to be used in the purchase of the necessary land for producing the munitions, and in due course, and before any of the funds were used, the President revoked his previous orders (hearings, p. 1072) allocating the $350,000 for this purpose in a memorandum as follows:

MARCH 13, 1919.

Memorandum for the Secretary of War:

I hereby authorize and direct the following revocation and allotments of funds appropriated by the Congress in the "section 124, nitrate supply," of the act approved June 3, namely:

Revoked:

The sums allotted by me November 27, 1917, and March 2, 1918, for the purchase of a site for an ammonium-nitrate factory, aggregating $350,000.

Allotted for use by the Secretary of War:

(*a*) For the purchase of United States patents protecting processes incident to nitrogen fixation, etc..... $10,000

(*b*) For the active prosecution of investigation of processes for the industrial production of nitrate compounds useful in the manufacture of explosives or fertilizers..... 340,000

Approved, April 8, 1919.

WOODROW WILSON, *President.*

A certified true copy, April 30, 1919.

P. B. CONVILLE,
Lieutenant, Ordnance Department, United States Army.

A true copy of a certified copy, signed by P. H. McConville, lieutenant, Ordnance Department, United States Army.

G. B. ATTERSALL.

(Purchase of site for United States nitrate plant No. 2, "Nitrate plants, Secretary of War, allotment F.").

February 4, 1919, P. R. 117960, procurement request No. 2487, apportionment $350,000.

May 10, 1919, revocation nitrate No. 27, F 112.4, procurement request No. 2487, apportionment $350,000.

(2878.)

The CHAIRMAN. The Attorney General did hold that the provision in the contract with you for the sale of the Government's interests in the Gorgas plant was illegal.

Mr. MARTIN. Yes, sir. He held this, Mr. Chairman: The Attorney General did hold that the Secretary of War could not agree to arbitrate the value under the act of 1918.

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Mr. DENT. Or to grant an option?
Mr. MARTIN. Yes; or could not grant an option.
The CHAIRMAN. Did he not hold that they could not sell it?
Mr. MARTIN. No, sir.
The CHAIRMAN. Then his modification of the opinion of the War Department's legal advisor was to the effect that the arbitration part of the contract was null and void?
Mr. MARTIN. Yes, sir.
The CHAIRMAN. But that the Secretary could sell the plant?
Mr. MARTIN. Yes, sir.
Senator CARAWAY. But he did hold that your contract was void, but he went further and said now if the Secretary wanted to sell it to you he had the power to do it, but he was under no legal obligation to do it by reason of the contract.
Mr. MARTIN. Now, Senator, just a moment. He held that that feature of it which gave us the option to require the Government to convey it to us was not binding on the Government.
Senator CARAWAY. That is what I meant.
Mr. MARTIN. Yes, sir; but he did not hold that the other feature, namely, the feature requiring the Government to demand of us to buy before it sells to some one else, was not binding.
Senator CARAWAY. Yes.
Senator HEFLIN. I supposed Mr. Dent was going to discuss that at length.
Senator CARAWAY. That would be in effect holding that on one leg of the option you are bound and on the other you are not.
Mr. MARTIN. Now, Mr. Chairman, the only point that is important for us to determine under that opinion is simply as to whether the Alabama Power Co. is bound to pay the arbitration value or fair value of the property. Now, curiously, we find ourselves in this position. We never contended that we were not bound—in fact, have always contended that we were bound in good faith to carry out all of our obligations under the contract, and have been and are ready and willing to carry them out. Certain officials of the Government have contended that we were not bound by certain provisions. We stand ready to pay any award made by the arbitrators. If you will examine Article XXIV of the contract, you will find that any award signed by two of the arbitrators is final and conclusive, and in common law and on every principle of jurisprudence we would be subject to suit by the Government to recover the amount of the award. From your own State, Mr. Chairman, there came the Supreme Court opinion in one of the leading cases on this subject, namely, the City of Omaha *v.* Omaha Waterworks (218 U. S. 180), in which case the Supreme Court of the United States held the city of Omaha was bound by the result of an arbitration to buy a waterworks system where the arbitration was entered upon and an award made, and a bill for specific performance was sustained to require the city to execute the award. We have never considered we were not bound by the result of the award.
The CHAIRMAN. Let me see if I get that right. As I understand you, now, the position of the Alabama Power Co. is that you are willing to go ahead under the contract?
Mr. MARTIN. Yes, sir.
The CHAIRMAN. Or you are willing to go ahead without that provision and buy if you can agree on a price?
Mr. MARTIN. Yes, sir.
The CHAIRMAN. And you will let the Government take either course it wants to?
Mr. MARTIN. That is correct, Mr. Chairman.
There is one other thing, Mr. Chairman, in the offer of the Alabama Power Co., which I want to make clear to the committee. We have proposed a plan under which this Wilson Dam might be completed and 100,000 horsepower made available to the Government or its designee or its nominee. It has been suggested in the testimony that there would be required an amount of primary power continually available in connection with the operation of nitrate plant No. 2. I understand it is the idea that 10,000 horsepower should be continually available if the balance of the palnt is to be operated upon secondary power. Now if some plan seems feasible from the Government's point of view for working this matter out on the basis of 100,000 horsepower, I just want to say that so far as we are concerned the 10,000 continuous primary power and 90,000 secondary power would be a plan which could be worked out, that is, the 100,000 continuous primary power to be available, and the balance on the basis of secondary power. That would be a substantial increase in the value of the power to be made available to the Government, and would, of course, meet one of the points that has been suggested before the committee, that the secondary power might interfere at times with the proper maintenance of the plant.

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Senator McKINLEY. To put it in plain figures, at least to my mind, your suggestion is that the Alabama Power Co., or your suggestion has been that the Alabama Power Co. would put up the money itself to complete Dam No. 2, and you now say that as rental for the right to use Dam No. 2 the Alabama Power Co. would provide 10,000 of primary steam power, if necessary?

Mr. MARTIN. Continuous power from any source.

Senator McKINLEY. And then 90,000 horsepower of secondary power. Now, what I want to ask you is on the average, as has been shown there in the water supply, for how many months of the year would the Government have available 90,000 horse power?

Mr. MARTIN. From nine to ten months.

Now, Mr. Chairman, I want to make this further statement:

Our company is engaged in the generation and distribution of power in Alabama. We have a very large power load which we are serving to the public in many parts of the State. That power load is continually increasing from week to week in response to the demands of the present industries and new industries. For instance, we have in negotiation to-day, power negotiations to-day, with various coal mines, iron ore mines, municipalities, public utilities, steel mills, textile plants and miscellaneous industries, involving 76,825 horsepower connected load.

Senator McKINLEY. Your statement about negotiations is confusing to me. Do you mean that that is new business you have in sight?

Mr. MARTIN. Yes, sir; this is new business we have in sight which, of course, is in addition to our present load which we are carrying, Senator, of approximately 160,000 horsepower. We have entered upon a program, in other words, of taking on new business, because we are building a large power plant of 110,000 horsepower, and we want to have the load available for that plant when it comes in next year, and we can not carry this big load this year even with the Warrior plant. We have rented from the Government the steam plant at Sheffield to enable us to carry this load this year and possibly part of next. The Sheffield plant is rented, of course, under an arrangement terminable at will by the Government, but we are doing this in response to the demand of industry for power in Alabama, and because, naturally, we want to build up a load to absorb the power we bring into the market.

This very large load of power which we deliver goes into industry very largely in our State. I want to give you, Mr. Chairman, some idea of the basic industries which are dependent upon this source of power.

We have 57 coal mines in Alabama that are now electrified. These mines produce an annual output in value of coal at present prices of $18,000,000.

Pig-iron mines electrified, with an annual output of approximately $15,000,000.

Two very large cement plants, with an annual output in value of $8,000,000.

More than 50 per cent of all the textile mills of our State, with an annual output of approximately $40,000,000.

A ferrophosphate and phosphoric acid plant at Anniston, with an output of $2,000,000.

Miscellaneous plants and industries which we have roughly estimated at $50,000,000, making a total of approximately $133,000,000 in value of the annual output of plants that are electrified and have come onto the system of the Alabama Power Co. upon the understanding and agreement with us that they would have continuous service of power. Stated in another way, these plants have more than $300,000,000 of investment, employing approximately 25,000, having under normal conditions an annual payroll of $75,000,000.

Senator HEFLIN. You mean you are serving these industries from all of your plants?

Mr. MARTIN. Yes, sir. And, Senator, if the proposal made by Mr. Ford to take the Warrior Plant should succeed it will have a very disastrous effect upon industries in Alabama, and not alone our company. It will react into this great industrial situation in Alabama, and our company has, in response to demand, extended its lines and its service to practically all parts of industrial Alabama. Now, we can not, on a water-power plant, carry this load, or anything like it. It is going to take steam plants to do it, because, as you know, the Coosa River runs down very low in summer, and that is a very vital question to the industrial situation in Alabama to-day and in the future.

Senator HEFLIN. You know, as I said in the outset, I would not favor depriving those coal mines that are now being served by the Gorgas plant of that service, it doesn't make any difference who gets it.

Mr. MARTIN. Yes, sir; and I just want to say to you, Senator, that the only way by which you can take any part of the Warrior plant is to take it all, and those on the other side recognize it, who are demanding this plant. If you did that industrial Alabama would be very vitally affected, and you would see it all over the State where electric power is now an essential industry.

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The CHAIRMAN. What kind of contracts do you enter into with those municipalities and those various industries, mines, etc., as to time? Can you terminate those contracts?

Mr. MARTIN. No, sir. We can not. Those contracts vary in term. They run for 5 to 20 years. Our company is obligated to deliver service and——

The CHAIRMAN. Under the laws of Alabama how long a contract can you make?

Mr. MARTIN. There is no limit to the time.

The CHAIRMAN. There is no limit?

Mr. MARTIN. No, sir; there is no limit except on the——

The CHAIRMAN. If Mr. Ford's offer was accepted and he took the Government's interest in the Gorgas plant, and if you were able to show that because that was done you were unable to comply with your contracts, would not you be able to recoup yourself? Would not the Government be liable not to you alone, but to your licensees?

Mr. MARTIN. Well, I should think that if there should be a condemnation suit, or a suit to take away these properties, that is an element of damage which will have to be taken care of.

Senator CARAWAY. Let me ask you a question. In your contract that you make with the coal mines, for instance, are you obligated to furnish them power for 20 years?

Mr. MARTIN. It depends upon the terms of the contract.

Senator CARAWAY. If the contract is for a 20-year term, you make a contract that you will furnish power for 20 years?

Mr. MARTIN. Do we?

Senator CARAWAY. Yes, sir.

Mr. MARTIN. Yes, sir.

Senator CARAWAY. Are there not provisions under which you can get out?

Mr. MARTIN. No, sir.

Senator CARAWAY. Suppose the public service commission were to order you to reduce your rates and you would say you could not do it; what would be the result?

Mr. MARTIN. That would not make any difference so far as concerned our obligation to continue to furnish power.

Senator CARAWAY. Well, what would be the result?

Senator MCKINLEY. The result is they would appeal to the courts.

Mr. MARTIN. That question of rate does not determine the question of whether we shall furnish continuous service, because the rate regulating bodies now have the power, within constitutional limits, to decrease or increase rates of such companies as Alabama Power Co.; and all contracts we make are in law made with that legal power inherent in the contract. We have to deliver service at a rate to be fixed by the commission, subject to review in the courts.

Senator CARAWAY. Suppose you should determine that you can not deliver. You go in the courts and refuse to deliver, don't you?

Mr. MARTIN. No, sir; we can not refuse to deliver service. The question of rates is another matter, Senator.

Senator CARAWAY. Have you a sample of your contract with you?

Mr. MARTIN. No.

Senator CARAWAY. Will you give us one to be put into the record?

The CHAIRMAN. Are your contracts all the same?

Senator CARAWAY. If you make that kind of a contract, I never heard of any other company that did.

Mr. MARTIN. We are relieved from acts of God from delivering service and from breakdowns temporarily.

Senator CARAWAY. Strikes, and everything else? I have been somewhat familiar with it and I have never seen one yet but what there were so many exceptions that the company could get out of it. If you have a different one, I would like to see it.

Senator MCKINLEY. I should say we have plenty of them, and there is no way to get out of them except for strikes or acts of God. You can not get out just because you want to.

Senator CARAWAY. You say you can't, but you have so many conditions you can always get out of it. You put one of yours in, and let him put one of his in.

Senator MCKINLEY. I think it would be a good idea to shut down all of these plants in Alabama and let Mr. Ford have it.

Senator CARAWAY. And let you and other private plants run so that you can make money. I understand it thoroughly.

The following is the contract between Alabama Power Co. and Stith Coal Co., Mr. A. B. Aldridge, one of the witnesses appearing to-day, being secretary and treasurer of the company:

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CONTRACT FOR ELECTRIC POWER—WHOLESALE RATE, THREE-PHASE ALTERNATING CURRENT, NOT LESS THAN 50 KILOWATTS.

Agreement made this 26th day of February, 1918, by and between Alabama Power Co., hereinafter called the "company," and Stith Coal Co., hereinafter called the "consumer."

In consideration of the mutual agreements hereinafter contained, it is agreed:

First. That during the term of five years from the beginning of service (not later than the 1st day of May, 1918), and thereafter until the expiration of at least six months written notice to either party of intention to terminate this agreement, the company shall maintain ready for delivery to the consumer at a division switch located at the power house at the mine Stith Coal Co., section 26, township 15, range 7, in Walker County, Ala., electric power of a capacity of 150 kilowatts, in the form of approximately 60 cycles, three-phase, alternating current, at a pressure of approximately 2,300 volts, for which the consumer shall pay a charge of $1.25 per kilowatt per month, based on the consumer's maximum average five-minute load during such month; provided, however, that such load shall be figured at not less than 75 per cent of the maximum average five-minute load during the 11 preceding months; and provided further, that during the first year (or during the year following any increase of capacity as hereinafter permitted) such load shall be figured at not less than 75 per cent of the capacity required to be maintained. At no time shall such charge be for less than 50 kilowatts.

Second. That in addition to the charge for capacity, which shall be paid even though the service may be suspended or interrupted as hereinafter mentioned, the consumer shall pay a charge for energy, based on the number of kilowatt hours actually consumed each month, in accordance with the following schedule: For the first 1,000 kilowatt hours, or less, per month, 3 cents per kilowatt hour; for the next 3,000 kilowatt hours, or less, per month, 2 cents per kilowatt hour; for the next 16,000 kilowatt hours, or less, per month, 1 cent per kilowatt hour; for the next 30,000 kilowatt hours, or less, per month, 0.6 cent per kilowatt hour; all above 50,000 kilowatt hours, per month, 0.4 cent per kilowatt hour.

Third. Bills shall be rendered monthly, and if not paid at the company's office within 10 days the company may, upon 5 days' written notice, suspend service; and if not paid within a further period of 15 days the company may, at its option, treat this agreement as canceled and at an end, whereupon all rights of the consumer hereunder shall cease.

Fourth. If at any time the consumer desires to increase the capacity required to be maintained, 60 days' written notice thereof shall be given to the company, which shall then make the required increase; provided however, that the total increase shall not exceed 50 kilowatts during any six consecutive months, and provided further, that the company shall not be required to make any increase within one year next preceding the expiration of this agreement.

If for a period of 12 consecutive months the capacity required to be maintained exceeds by over 10 per cent the consumer's maximum average five-minute load during the same period the company may, upon 30 days' written notice, decrease the capacity by the amount of the overexcess, subject to increase again only as provided.

If at any time the consumer's maximum average five-minute load shall exceed the capacity then required to be maintained the company may so notify the consumer, and, upon any subsequent excess, without further notice, suspend service until such time as it is satisfied that the consumer will thereafter keep within said capacity. And the consumer shall be liable for all damages resulting to the company by reason of any such excess or excesses. The company may interrupt the service without notice at any time a momentary overload shall exceed said capacity by more than 75 per cent or by more than 25 per cent in case said capacity shall be over 400 kilowatts.

Fifth. Without the written consent of the company the consumer shall not use any electric power other than that furnished hereunder, or any other power where that furnished hereunder has once been used; nor shall the consumer sell or dispose of any power furnished hereunder, or which may be generated directly or indirectly therefrom.

Sixth. All transformers, transmission lines, switches, machinery, and materials up to and including the division switch, and all the company's meters wherever placed, shall be supplied, maintained, and owned by the company, at all times open to it for inspection, repair, or alteration, and removable at its option; and the consumer shall supply without charge suitable buildings and accommodations therefor. Everything beyond the division switch shall be supplied, maintained, and operated by the consumer with a view to securing a power factor satisfactory to the company, and shall be subject at all times to the inspection, testing, and approval of the company in so

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far as the same may in any way affect the safe, economical, and successful operation of the company; and no change which might affect such operation shall be made without its approval.

The consumer shall use reasonable diligence to protect the property of the company, shall reimburse the company for injury or damage suffered by it resulting from defects beyond the division switch, or from the negligence of the consumer, and shall indemnify it against liability for injury or damage so suffered by third parties; and except as herein provided the company shall not be liable for any accident, damage, or injury to any person or property whatsoever arising out of or in any way connected with the service furnished or to be furnished hereunder.

The consumer shall allow the company free access and entry to the consumer's properties and premises, and shall, upon request, convey to the company in fee, or otherwise, to the fullest extent that the consumer's interest may permit, convenient locations and right of way for such transmission lines as may be required for service to the consumer and to others who may be most economically served therefrom.

Seventh. The obligations of the company are dependent upon its securing and retaining the necessary rights, privileges, franchises, and permits, and in the event that it is delayed in the delivery of power by injunction, strike, riot, invasion, flood, fire, accident, breakdown, delay in obtaining material or apparatus, or any cause beyond its control, the time fixed for the commencement of the term of this agreement shall be correspondingly extended. The company shall not be liable to the consumer for interruptions in the service due to any of the causes aforesaid, but shall use the utmost reasonable speed in restoring the service, and during such interruptions the consumer shall have the right to use such other power as may be available.

Eighth. A waiver of one or more defaults shall not be considered a waiver of any other or subsequent default.

Ninth. Before this agreement shall become binding upon the company it must be approved in writing indorsed below, by an officer of the company. All previous communications between the parties hereto, whether verbal or written, with reference to the subject matter of this agreement, are hereby abrogated, and no modification hereof shall be binding unless it shall be in writing duly accepted by the consumer and approved by an officer of the company. This agreement shall inure to the benefit of, and be binding upon, the successors and assigns of the parties hereto.

ALABAMA POWER CO.,
By D. H. CRONHEIM,
Commercial Agent.
STITH COAL CO.,
Consumer.
By A. B. ALDRIDGE,
Secretary and Treasurer

Approved.

ALABAMA POWER CO.,
By W. M. WALMSLEY,
Vice President.

The foregoing is one of the company's standard forms of contract for wholesale power.

Senator MCKINLEY. Let me ask you, do you have to pay taxes in Alabama?

Mr. MARTIN. We had a 10-year tax exemption on our Lock 12 hydro-electric plant, which expires this year. However, we paid last year approximately $145,000 of taxes on our properties which were not exempt. This amount of taxes will be substantially increased hereafter. Some classes of property are still exempt from taxation but beginning with this year we will pay taxes on all,

Senator MCKINLEY. Does the public utilities commission control your rate?

Mr. MARTIN. Yes, sir. Rates, service, and security issues.

Senator CARAWAY. And permits you to charge off your taxes, of course, as an expense, and you raise your rates to meet it.

Mr. MARTIN. That is a part of the operating expense, you know.

Senator CARAWAY. The question was intended to leave the impression that the taxes were given to the State.

Senator MCKINLEY. The impression I wanted to make later was that Mr. Ford pays no taxes.

Senator CARAWAY. The impression was that this thing was a gift also to the State, and the State would lose $140,000, and the question was obvious.

Mr. MARTIN. Of course we have to pay taxes in future even on that property which was exempt, and we will continue to pay. As Senator Heflin knows, that is simply a 10-year exemption, and it runs out this year.

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Senator HEFLIN. The State passed a statute years ago, as an inducement for industry to come into the State, that it should be exempted for a period of 10 years, and your contract has about expired.

Mr. MARTIN. Yes, sir. I would like to put into the record some lighting and power rates charged by our company in Alabama and some comparable rates charged in other cities in the South and North. I don't want to take the time of the committee unnecessarily to go into that. If the committee wants to do it, I will, but if not, I will put it in the record, and also some power rates.

The CHAIRMAN. Let me ask you, how many municipalities do you supply with light?

Mr. MARTIN. Directly and indirectly, 63.

(The statement referred to is as follows:)

In a report recently prepared by Messrs. Murray and Flood on the development of electric light and power utilities in Ontario it is shown that the Ontario utilities, which are government owned, furnish power at an actual average cost of 9.25 mills per kilowatt hour generated. The Alabama Power Co. in 1921 generated power on a comparable basis for 7.5 mills per kilowatt hour, or practically 20 per cent less than the efficient Canadian plants.

In 1914, the connected system load was 7,500 horsepower, used by five customers. The market demand has steadily increased until at the close of 1921 the company had a total connected load of 370,000 horsepower, and an annual output of 500,000,000 kilowatt hours, serving 158 major industries in 25 counties in Alabama, as follows:

Industries and number at close of 1921.

Brick plants	2	Electrochemical plants	1
Cement plants	2	Municipal lighting systems	3
Cotton mills	30	Municipal pumping systems	3
Coal mines	46	Public utilities	18
Cotton gins and oil mills	7	Lime and marble quarries	8
Foundries and machine shops	11	Steel plants	4
Graphite plants	5	United States Government	2
Ice plants	7		
Ore mines	9	Total	158

The above industrial consumers utilize 70 per cent of the total kilowatt-hour output of the company, the balance being absorbed by residential customers, street lighting, and street railway operation.

More than 80 per cent of the power output is absorbed in industry, and much of it is bought in large blocks of from 5,000 to 25,000 horsepower.

Rate schedules are low and compare favorably with rates in other sections and are such that manufacturers are enabled to secure not only efficient motive power but at prices that reduce cost of production.

The power rate includes a minimum demand charge of $1.50 per kilowatt, plus a charge for energy commencing as low as 5 mills, ranging upward. This energy charge naturally goes down as the amount of kilowatt hour consumption goes up. During 1921 the average returns of the company on all power sold was only 8.9 mills per kilowatt hour.

In 1907, before there were any large power developments in Alabama, the average horsepower cost per year was $72. In 1917 this had decreased to $21, or 70 per cent in 10 years. On the other hand, in the adjoining State of Mississippi, during the same period the per horsepower cost only decreased from $97 to $93, or 4 per cent. The latter State has no hydro power, which accounts for and illustrates the effect on power costs in communities where hydro power is made available.

The Alabama Power Co. is delivering power at considerably less than $18 per horsepower year. This figure is as low and in many instances lower than the rate in any other section of the country. The average charged rate per horsepower year by the hydroelectric power commission in Ontario is $21. This rate, however, increases with the distance from the generating plant until, in isolated sections, it is as high as $151 per horsepower year, while the Alabama Power Co. serves its customers regardless of location at a standard rate.

Lighting and power service is being furnished to 63 cities and towns, over an area of 25,000 square miles, 36 being served directly by this company. Current is carried ng distances over high tension transmission lines and through substations, stepped wn to low voltage for use by residential consumers. The communities served rectly by this company range in population from 500 to 30,000 and the town limits

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are almost invariably widely extended for future growth. Notwithstanding the fact that each community must have a separate operating and distributing system, the lighting rates of the company are as low as in Chicago, Detroit, and many other large cities where the utilities serve congested districts with from 100 to 500 per cent more consumers per mile of line. Our lighting rate, of 9 cents per kilowatt hour and gradually decreasing to 4.5 cents per kilowatt hour in proportion to the consumption, is more than a fair one to the consumer and is only possible through modern equipmen and a skilled organization.

Power is sold by the Alabama Power Co. to several municipalities in Alabama, which then in turn distribute to consumers. It is worthy of notice that these municipalities, without exception, charge higher rates than the Alabama Power Co. Several of these are indicated herewith, together with rates of cities in other sections:

Rates per kilowatt hour (in cents).

Alabama Power Co	9	Detroit, Mich	10
Lafayette, Ala.[1]	15	Chicago, Ill	10
Piedmont, Ala.[1]	12	Atlanta, Ga	9
Opelika, Ala.[1]	12	Columbia, Tenn	13.2
Sheffield, Ala	14	Jackson, Tenn	14.2
Baton Rouge, La	11	Chattanooga, Tenn	9
New Orleans, La	9.1	Athens, Ga.[1]	9
Greenville, Ala	14	Columbus, Ga	10
Meridian, Miss	11.7	Lagrange, Ga.[1] (hydro)	12
Hattiesburg, Miss	14	Waycross, Ga	11.7
Vicksburg, Miss	15	Pensacola, Fla	11.4

Mr. MARTIN. Now, Mr. Chairman, with your consent, I would like very much to get Mr. Aldridge, who is a business man in our state, to make a short statement. He is in the room.

The CHAIRMAN. Before this witness testifies I want to ask the present witness or Senator Heflin in regard to that exemption. Does that apply to all factories of all kinds?

Senator HEFLIN. Yes, sir. That is my understanding.

The CHAIRMAN. Is it still in existence?

Senator HEFLIN. Yes, sir.

The CHAIRMAN. If anyone else went down there and started a manufacturing site anywhere in Alabama they would be exempt from taxation for 10 years?

Mr. MARTIN. I had reference to the statute which granted an exemption to any person, firm, or corporation developing electric power, being section 2069 of the Code of Alabama of 1907.

Senator HEFLIN. Yes, sir. I remember a cotton factory, for instance, in 1907. I think the statute provided that any cotton factory that came into the State would be exempt for 10 years.

The CHAIRMAN. If Mr. Ford, for instance, built an automobile factory, would that be exempt for 10 years?

Mr. MARTIN. There is no law of that kind now.

The CHAIRMAN. There is not any exemption now?

Mr. MARTIN. Not of cotton mills now.

The CHAIRMAN. Is there for electric plants?

Mr. MARTIN. Yes, sir.

The CHAIRMAN. The same as before?

Mr. MARTIN. For 10 years.

Senator CARAWAY. That is merely to the company that furnishes the power?

Mr. MARTIN. Merely exempts the plants, including machinery and equipment necessary for the production, transformation, and distribution of hydroelectric power.

Senator CARAWAY. For furnishing power?

Mr. MARTIN. Yes, sir.

Senator CARAWAY. Not to the industries to which the power is supplied?

Mr. MARTIN. No, sir.

Senator CARAWAY. So that if he built a factory there—

The CHAIRMAN. He would have to pay taxes the same as anybody else, right from the beginning.

[1] Municipally owned.

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STATEMENT OF MR. A. B. ALDRIDGE, BIRMINGHAM, ALA.

The CHAIRMAN. Give your name.
Mr. ALDRIDGE. A. B. Aldridge, Birmingham, Ala.
The CHAIRMAN. What is your business, Mr. Aldridge?
Mr. ALDRIDGE. I am in the coal business. I mine approximately 2,000 tons of coal a day.
The CHAIRMAN. You are a coal miner?
Mr. ALDRIDGE. Yes, sir; a coal miner.
The CHAIRMAN. Are your coal mines located near Birmingham?
Mr. ALDRIDGE. Yes, sir; within about 5 miles of the Gorgas plant.
The CHAIRMAN. Farther up the river?
Mr. ALDRIDGE. No, sir. We are due north of the Gorgas plant.
The CHAIRMAN. You are not on the river?
Mr. ALDRIDGE. Not exactly on the river.
The CHAIRMAN. What is your nearest town?
Mr. ALDRIDGE. Jasper. Our shipping point is Parrish, Ala.
The CHAIRMAN. Jasper is in the same county that the Gorgas plant is located in?
Mr. ALDRIDGE. Yes, sir.
The CHAIRMAN. Is it the county seat?
Mr. ALDRIDGE. Of the county of Walker.
The CHAIRMAN. Are you a stockholder in the Alabama Power Co.?
Mr. ALDRIDGE. No, sir.
The CHAIRMAN. Have you any interest in it?
Mr. ALDRIDGE. My wife has 10 shares, $1,000, invested in it as a savings account.
The CHAIRMAN. Have you any other interest?
Mr. ALDRIDGE. No, sir.
The CHAIRMAN. Have you a contract with them for power?
Mr. ALDRIDGE. Yes, sir.
The CHAIRMAN. Do they supply you with power?
Mr. ALDRIDGE. Yes, sir. That is what aroused my interest and caused me to come to Washington.
The CHAIRMAN. Now go ahead in your own way and tell us what you wish to.
Mr. ALDRIDGE. Senator Heflin, when the committee came to Gorgas, I having known him practically all my life, met him down there with the idea that I would form some idea as to what a man in my position could expect as the outcome of this thing. My mines are located, as I told you a while ago, approximately 5 miles from Gorgas, and are solely dependent, along with 57 others, on the operation of this plant during the dry season.
Senator MCKINLEY. For power, you mean? Dependent for power?
Mr. ALDRIDGE. For power, yes, sir.
The CHAIRMAN. How much power do you take, or how much does it take to operate your mines?
Mr. ALDRIDGE. It is taking now about 650 kilowatts at one mine and approximately 1,250 kilowatts.
Mr. MARTIN. About 1,800 horsepower.
The CHAIRMAN. How long have you been getting that power?
Mr. ALDRIDGE. This is the fourth year.
The CHAIRMAN. What does the contract provide as to the length of time? How long are you entitled to get it under your contract?
Mr. ALDRIDGE. As long as required. As I understand the situation, they can not refuse to give me power.
The CHAIRMAN. You have a contract with them, haven't you?
Mr. ALDRIDGE. Yes, sir.
The CHAIRMAN. Have you examined that contract to see just what it provides?
Mr. MARTIN. I think that is 10 years with your company.
Mr. ALDRIDGE. Ten years at the time I made it.
Senator CARAWAY. You ran your mines before you got this power?
Mr. ALDRIDGE. Yes, sir. I had my own power plant at that time.
Senator CARAWAY. I inferred from your statement that if this was cut off you would have to close your mine?
Mr. ALDRIDGE. Yes, sir.
Senator CARAWAY. You could not run them now?
Mr. ALDRIDGE. I could after going to the expense of building my power plant.
Mr. MARTIN. How much money did you invest in electrifying your mine, Mr. Aldridge?

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Mr. ALDRIDGE. About $65,000 at the old place and I forget just what the investment was at the other.

Mr. MARTIN. In the matter of electrifying the mines, what amount would you say these mining companies have approximately invested in electrification?

Mr. ALDRIDGE. I think I got it cheap, because I have had——

Mr. MARTIN. Just express it in round figures, as near as you can.

Mr. ALDRIDGE. I guess the average would be a good deal more than I paid. Around $115,000 to $125,000 at some of the mines.

Senator CARAWAY. Didn't you have yours electrified before you got this contract?

Mr. ALDRIDGE. No, sir.

Senator CARAWAY. I thought you were using electricity then.

Mr. ALDRIDGE. No, sir.

Mr. MARTIN. Will you explain to the committee why you use electricity, and the advantages of it, in mining operations?

Mr. ALDRIDGE. I installed it because I found by the use of hydroelectric power I could save approximately 10 cents per ton on the cost of my coal on the cars.

Senator CARAWAY. The Gorgas plant is not a hydroelectric power plant is it? Is it it not a steam plant?

Mr. ALDRIDGE. Yes, sir; it is a steam plant.

Senator CARAWAY. You used the word "hydroelectric." You are not getting any hydroelectric power, are you?

Mr. ALDRIDGE. Yes, sir; during about eight months of the year.

Senator CARAWAY. You get that from the river?

Mr. ALDRIDGE. Yes, sir.

The CHAIRMAN. Is that gotten from the Alabama Power Co. also?

Mr. ALDRIDGE. Yes, sir.

The CHAIRMAN. You get all your power from that company, do you?

Mr. ALDRIDGE. Yes, sir.

The CHAIRMAN. Part of the year it is hydroelectric power, and part of the time it is created at Gorgas from coal?

Mr. ALDRIDGE. Yes, sir.

Mr. MARTIN. What percentage of the coal in Alabama is mined by companies whose mines are electrified, Mr. Aldridge?

Mr. ALDRIDGE. Approximately 51 per cent of the total production from Alabama is mined from mines which are served by the Alabama Power Co.

Mr. MARTIN. How much is the annual output of coal?

Mr. ALDRIDGE. Approximately 16,000,000 tons, and the mines which are electrified I believe show 8,414,179. That is the exact figure.

Senator CARAWAY. May I ask a question right there? Can you mine it cheaper where you have this hydroelectric power?

Mr. ALDRIDGE. Yes, sir.

Senator CARAWAY. Does it sell for the same all over the State? Every mine sells it at the same price?

Mr. ALDRIDGE. No, sir; every mine does not sell at the same price.

Senator CARAWAY. Do you sell cheaper than the other mines because you get your power cheaper?

Mr. ALDRIDGE. Different kinds of coal take different prices.

Senator CARAWAY. I know that, but are you selling this coal cheaper by reason of the fact that you are getting cheaper power?

Mr. ALDRIDGE. I am able to; yes, sir.

Senator CARAWAY. Do you do it?

Mr. ALDRIDGE. In a great many instances I sell it for less than what you would call a reasonable profit. To be frank with you, I have shown a profit of 7 cents a ton.

Senator CARAWAY. I am trying to find out whether the people get the advantage of this cheaper power you get, or whether you get the same price for your coal when you say it costs you less to mine it.

Mr. ALDRIDGE. Competition creates that very difference itself.

Senator CARAWAY. The mine that is not electrified can not sell at all, then, can it, if it costs him more to mine? You come here to convince Congress that it ought to let the people enjoy this cheaper power, because you can mine coal cheaper, and I want to know, then, whether you give it to the public or take it as private profit?

Mr. ALDRIDGE. I can explain in this way, if you will allow me to.

Senator CARAWAY. Yes, sir.

Mr. ALDRIDGE. We found that during the past 12 to 15 months, when the coal market has been simply covered up with coal, there has been more coal than any of us could sell, that the mines that are electrified have operated, because they could operate cheaper and sell their coal cheaper, and those that were not electrified, as a

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rule, when the coal market is very dull and coal on hand to sell, the low price of electricity enables us to keep the mines in regular operation and permit our employees to earn wages instead of shutting down the mines and throwing them out of work.

Senator CARAWAY. When there is a market do you all sell at about the same price?

Mr. ALDRIDGE. Practically, the different grades.

Senator CARAWAY. So the profit stays with the man who gets the cheaper power. I just wanted to know, because the public has some interest in what we are going to do.

Mr. ALDRIDGE. Yes, sir.

Mr. MARTIN. Explain as to the advantages of the electrification of a mine, as briefly as you can, Mr. Aldridge, and as quickly as you can.

Mr. ALDRIDGE. Well, to start with, I have no doubt the Senate is interested in living conditions. Prior to the coming into Alabama of hydroelectric power our mine camps were at night as dismal places as any man ever went into. There was nothing there but an ordinary oil light. There were no conveniences. To-day you go into a mine camp—and I would be glad to take this committee into mine—and you can find the lady there with a washing machine being operated by electricity. You can go in on the breakfast table and find them cooking their toast like Senator Heflin has his. You will find their houses lihgted up, and playgrounds. You will find running water in practically every house, made possible because we can convey this power to different points where we can get good water supply.

In other words, you will find the miner, instead of living in a dark hovel, as they did when I first went into the mines 20 years ago, you will find him living there with his lights shining and happy.

Mr. MARTIN. What about the effect on labor and the dangers in mine operations?

Mr. ALDRIDGE. We find that the casualties in Alabama have been reduced—I forget just what the percentage is, but it is enormous.

The CHAIRMAN. That would not all be on account of electricity?

Mr. ALDRIDGE. Not altogether; no, sir.

The CHAIRMAN. You have made other improvements in other lines? This is only one of them?

Mr. ALDRIDGE. That is waht I want to call your attention to. In mining coal with electric mining machinery, it so fixes the coal that we don't have to put a heavy charge of powder in it. Ninety-five per cent of the explosions in Alabama have been caused by heavy charges of powder being placed back down in the faces of the coal in order to bteak it down, as we call it, from the solid, and instead of that powder taking effect in the coal and pulling it, to use the miner's expression, it blows it and makes what we call a windy shot, first igniting the gas, and then a dust explosion, and no doubt your records will show that we have killed as many as 112 by the old method, I believe, at one time. That is what causes it. With the use of electric mining machinery it is not necessary to use strong explosives. We simply used a little powder, and that does away with the opportunity of creating a dust explosion. It also leaves our props in better shape, because with the heavy shot we always blow down our props, and with a light shot we always leave them in position, and our men can go back and go to work in safety. I have had one man killed in four years, mining around 300,000 tons of coal a year.

Mr. MARTIN. If you did continue to use electric power, is it possible for a mine to set up its own generating plant?

Mr. ALDRIDGE. It is possible.

Mr. MARTIN. But as a matter of cost it is prohibitive?

Mr. ALDRIDGE. It just raises your cost about 10 to 12 cents a ton, which is, in a great many instances, more than our margin of profit.

Mr. MARTIN. You would have to go to some other source of power, then, such as gasoline or steam, in case your present source of power is discontinued?

Mr. ALDRIDGE. Yes, sir. Now, some weeks ago, I had a good many of my friends who live out in Walker County come to me and ask me what was going to be the outcome of this Gorgas situation. Their reason for coming to me was that I am a member of the board of governors of the Alabama Mining Institute. They wanted to find out where they would stand if Gorgas was taken away from the Alabama Power Co. After thinking that matter over I wrote Mr. Hoover a letter, and I have his acknowledgement of the receipt of that letter. He said he would refer it to Secretary Weeks, but we got no definite information from Mr. Hoover as to what we could expect.

Mr. MARTIN. Would you like to read that into the record?

Mr. ALDRIDGE. If you would allow me to.

The CHAIRMAN. All right.

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Mr. ALDRIDGE. I first wired Mr. Hoover, then wrote him this letter:

SITH COAL CO.,
BROWN-MARX BUILDING,
Birmingham, Ala., June 2, 1922.

Hon. HERBERT HOOVER,
Secretary of Commerce, Washington, D. C.

SIR: Referring to my wire to you of June 1, 1922, copy of which is attached hereto, I beg to supplement the same by this letter and inclosure.

As you are probably already informed, the coal mines producing over 50 per cent of the coal mined in this State use in their operations the electric service of the Alabama Power Co. The power served by the Alabama Power Co. to these mines is produced at Lock 12 on the Coosa River and at the so-called Gorgas steam plant on the Warrior River in Walker County. The Gorgas steam plant is an auxiliary plant used to supply electric current during the dry seasons of each year, lasting from late June until early October, when the flow of the Coosa River at Lock 12 is not sufficient to meet the demands of the power company. Attached hereto for your information in this connection is a list of the mines served by the Alabama Power Co.

As you are also informed, the strike conditions prevailing in Pennsylvania, Ohio, Kentucky, and other regions are not prevalent in this State, but in order that the coal production of this State be utilized to its fullest capacity in relieving the scarcity of coal which faces the entire country during the months of July, August, and September, it is necessary that the service of the Alabama Power Co. to the mines named on the list herein inclosed be maintained.

Under its contract with the United States Government relative to the Government extension of the above mentioned steam plant at Gorgas on the Warrior River, the Alabama Power Co. is supplying by means of such extension electric service to these mines. It has been noted that the House Military Affairs Committee in making a suggested change to Henry Ford in his offer for the Muscle Shoals properties advised Mr. Ford that the Gorgas steam plant should not be included in the negotiations for such properties, but that Mr. Ford refused to make his offer conform to this suggestion of the committee. This position of the Military Affairs Committee is entirely justified in connection with the facts in regard to the contract between the Alabama Power Co. and the Government, and any other decision tending to disrupt the service of the power company from that plant would cause the cessation of operations during a great part of the months of June, July, August, and September at the mines shown on the within inclosure.

Regardless of any contention between the Alabama Power Co. and Henry Ford, and without taking either side, I feel that the industrial situation in the mineral region of this State demands that the Gorgas steam plant as an entirety be allowed to remain in the service in which it is now engaged and trust that you and your department will investigate the matters herein mentioned very fully, and if necessary communicate the same to the House Military Affairs Committee and the Senate Agricultural Committee, which are now considering the offers of Alabama Power Co. and Henry Ford for the Muscle Shoals properties.

The interests of the coal operators and miners and the public to which they owe their duty of full production should be considered in the matter of the disposal of the Government's interest in the Gorgas steam plant. The present situation in which it is threatened to turn the same over to Henry Ford places them in the position of the innocent bystander of the shooting affray between the power company and Ford, which, however blameless on their part, is nevertheless very uncomfortable, I assure you, and fraught with danger to the interests of the public with which your department is concerned.

If there is any further information which your department desires, either by correspondence or by demanding my presence in Washington, I will be glad to comply with your wishes at my expense.

I am sir, respectfully yours,

A. B. ALDRIDGE.

The CHAIRMAN. For the purpose only of shortening the hearing, while I have no objection to letters like that being read, it extends the hearings to such an extent, I think the fact that such a letter was written, or something of that kind, could be mentioned without reading it all into the record.

Mr. MARTIN. The Secretary acknowledged receipt of that letter?

Mr. ALDRIDGE. Yes, sir.

Mr. MARTIN. That is all from this witness, Mr. Chairman.

The CHAIRMAN. Are there any questions by any members of the committee? If not, we will hear the next witness.

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STATEMENT OF MR. FRANK NELSON, JR., BIRMINGHAM, ALA.

Mr. MARTIN. State your business, Mr. Nelson.

Mr. NELSON. I am a coal operator in Birmingham. Well, I have a good many interests there, but my principal business is in coal. I am also a member of the Manufacturers' Association in Alabama.

Our Mr. Sevier, president of the Manufacturers' Association of Alabama, wanted to come to Washington to attend this hearing, and wrote me a letter giving his views, and asked me to be kind enough to represent the association and present them with this short letter embodying his views, which are the views of the members of the Alabama Manufacturers' Association.

I will present the letter, with your permission.

The CHAIRMAN. All right. It will be put in the record.

Mr. MARTIN. I will say that that letter is of such a character that I would like to have you examine it and see if you will put it in the record.

The CHAIRMAN. It will be printed in the record.

Mr. NELSON. The letter is short.

The CHAIRMAN. If it is short, you can read it if you want to.

(Mr. Nelson thereupon read the letter referred to, as follows:)

ALABAMA MANUFACTURERS' ASSOCIATION,
Birmingham, Ala., June 19, 1922.

Mr. FRANK NELSON, JR., *City.*

DEAR SIR: In connection with the hearings now pending before the Senate Forestry and Agricultural Committee at Washington (which hearing I understand you will attend, and which I would kindly ask you to represent the Alabama Manufacturers' Association) concerning the disposal of Muscle Shoals property to Mr. Henry Ford under his offer, it is our desire that certain information with reference to the Gorgas steam plant situated on the Warrior River in Walker County, Ala., be brought to the attention of the committee as affecting the members of this association and their industries, the said association's membership having more than 125 different classified manufacturing interests distributed through 42 counties of the State, the greater number of which are in the territory served by the Alabama Power Co., the said interests having more than $300,000,000 invested in their plants, employing approximately 125,000 people, and under normal conditions a pay roll of $75,000,000 annually. Many of our members are coal operators, more than 50 per cent of which are users of the Alabama Power Co.'s power.

As you are informed, during the low-water season on the Coosa River, generally lasting the greater part of the months of July, August, September, and October, approximately 57 per cent of the electrical load of the Alabama Power Co. is carried by the Gorgas Steam Plant when the flow of the Coosa River at Lock 12, its hydroelectric plant, is not sufficient to meet the power demands of that company.

The Gorgas Steam Plant, so I am informed, supplies this power by means of the joint operation of two steam turbines, one of which was erected under contract between the United States Government and the Alabama Power Co. giving the right to the power company to operate the same for its own use upon paying certain rental and other conditions. This association has been authoritatively informed that any disposal of the Gorgas Steam Plant abrogating the terms of the contract between the power company and the Government will result during the dry season of each year as mentioned above, if not in cessation, at least in the most serious curtailment of the electrical service of the power company upon which a great number of the industries represented by this association are dependent for their operation.

As you are also informed, during the past several years in which the industries represented by this association have begun to use the electric power service of the Alabama Power Co., a great number of them, including coal mines, cement plants, cotton mills, and other industries, have dismantled their power plants, relying upon the service of the power company as a public utility for the supply of their electrical needs.

It is not the desire of this association to indorse or condemn any of the offers now pending concerning the disposal of the Muscle Shoals properties, but it is desired to call to the attention of the governmental authorities who are to pass upon this question the fact that other parties than Mr. Ford and the power company are interested in the disposal of the Government's interest in the Gorgas steam plant, and that the industrial situation in Alabama will be seriously and irremediably affected by the removal of that plant from the service in which it is now engaged. For that purpose it is requested that you appear before the Committee on Forestry and Agriculture of the United States Senate as a representative of this association and present to them the

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relation of the electric power system of the Alabama Power Co., and particularly the Gorgas plant, to the manufacturing, mining, and other industries of this association, amplifying the facts herein set forth by such data and statements as your broad knowledge of the industrial situation here dictates.

Yours very truly,

L. SEVIER, *President.*

Mr. MARTIN. Will you just make a statement in your own way, please?

Mr. NELSON. Mr. Chairman, I have been in the coal business and other lines in Alabama for several years, not quite as extensively in the coal business now as I have been, having sold three of my operations, but I still have two that were formerly supplied with steam produced by a power plant of my own. About four years ago I made a contract with the Alabama Power Co.—my recollection is for some 10 years—and I dismantled and sold off my plants. I do not mean to say that I would be compelled to shut down my mines a part of the year if the Gorgas plant is taken away from the power company, but I could not operate during the low-water season until I rebuilt my power plant at great expense, which I would not, of course, like to do. I do not understand and have never understood, the complicated situation with reference to the Gorgas plant. I have had—as I have stated—a great deal of experience in the coal business and in other lines in Alabama, and with the situation as I see it and a larger power plant at Sheffield I just can not conceive of the necessity of the Gorgas plant in connection with the other proposition at Muscle Shoals.

The lowest freight rate on coal delivered to the river is 87½ cents, and you can't get it on the river without opening a coal mine, and that takes something like the same length of time it takes to build a power plant. I was unfortunate enough to go on a bond to build a couple of locks on this same river, lower down, and I know something about the cost of getting coal to the river, putting it in barges, barging it down the river, taking it out again and delivering it to a steam plant, and it seems to me if Mr. Ford wants power he can get coal delivered at the Sheffield power plant just about as cheap as he can at the Gorgas plant, unless he acquired the coal at Gorgas owned by the Alabama Power Co. I have no objection to Mr. Ford getting the Muscle Shoals proposition and am not here fighting Mr. Ford, but I simply mean to state that it is not essential for Mr. Ford to own part or all of the Gorgas plant, even for temporary power.

Mr. MARTIN. Unless he should acquire the coal mines immediately at the plant, then he would be under the necessity of bringing coal to the plant from other localities?

Mr. NELSON. Now, Mr. Martin, you can make your own figures. The lowest rate he can get coal to the river for is 87½ cents. You have got to get the coal to it in the river, in the barges, barge it down to Gorgas and unload it and get it to this plant, as the Gorgas plant is not located on any railroad. The rate to Sheffield, I believe, is $1.60 or $1.70 per ton. It looks to me like he can get the coal to the power plant at Sheffield, a plant that is already built, and very much larger and finer than the one at Gorgas, quite as cheaply as he could get it to the Gorgas plant, assuming that he did not own or control the coal mine at Gorgas belonging to the Alabama Power Co. If this were done it would save all the darned complications touching the Gorgas plant.

The CHAIRMAN. He expects to use the coal that is mined at the Gorgas plant right there.

Mr. NELSON. I know, but he doesn't own it.

The CHAIRMAN. I know he doesn't own it, but I presume he expects to buy it from the Alabama Power Co. He could buy from them cheaper than he could buy from somebody else and ship it in there.

Mr. NELSON. I don't know, of course.

Mr. MARTIN. Assuming that the Alabama Power Co. would desire to sell it.

Is not this true, Mr. Nelson, that there are a number of favorable locations on the Warrior River near undeveloped coal where a steam plant could be located?

Mr. NELSON. Dozens of them.

Mr. MARTIN. So that if he would locate a steam plant at some other locality on the Warrior River he could obtain whatever advantages there are at the Gorgas location?

Mr. NELSON. I don't see why he couldn't.

Mr. MARTIN. Will you go forward into your ideas as to the effect upon industry in general of being deprived of electric power, Mr. Nelson?

Mr. NELSON. It seems to me, Mr. Martin, before an intelligent committee like this that is altogether unnecessary. If you cut off for a part of the year practically one-half of the power furnished by the Alabama Power Co. that a large number of textile mills, cement mills, and coal mines use, it ought to be apparent to everybody just what effect it would have. Whether or not Mr. Ford, if he takes your place and gets this property, will supply this power to these coal mines and textile mills and cement

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plants, I don't know, but if he did not do so the condition would simply be deplorable, because, as I said, in both my coal mines I have dismantled my power plants.

The CHAIRMAN. Take your case, now. Suppose the Government takes this plant away from the Alabama Power Co. and gives it to Mr. Ford, and then he uses the power himself and does not let you have any of it, and the result would be that your contract was violated; you would have an action for damages, of course, wouldn't you?

Mr. NELSON. Well, I am not a lawyer.

The CHAIRMAN. If they do not supply you with electricity you could sue the Alabama Power Co., and they in turn the Government who took the plant away from them, and get your money back, couldn't you?

Mr. NELSON. I would think so.

The CHAIRMAN. It would seem that if your contract was violated by the other parties they ought to pay you whatever your damages would be.

Mr. NELSON. I think probably that is true.

Mr. MARTIN. On the other hand, even assuming——

Mr. NELSON. But, gentlemen, I don't want to get into a lawsuit if I can help it.

Mr. MARTIN. Even assuming that you could be reimbursed some of your damage that you might sustain, is it not true, Mr. Nelson, that, if your coal mine can not supply your coal that you may be under contract to deliver, that interferes with your business?

The CHAIRMAN. That would be one of the elements of damage. The Government, if it was the cause of your violating all your contracts, would have to pay you your damages.

Mr. NELSON. You can imagine what a complication I would have with two coal mines closed for want of power, with contracts for the sale of coal to a great number of people. I would probably have people bringing suits against me for a breach of my contracts, and I would be suing the Alabama Power Co. and the Alabama Power Co. suing the Government.

The CHAIRMAN. That would make a good lively business for the lawyers.

Mr. NELSON. I went on a bond with the Government for $200,000, to build a couple of locks on the Warrior River, and finally they took one of them over for completion. I employed a number of lawyers down that way and some up here, and it took me about four years, and I never got started in the matter of adjusting the damages claimed, and I finally paid it.

Mr. MARTIN. What was your loss?

Mr. NELSON. About $135,000. There were two of us. Another party, one-half.

Mr. MARTIN. Now, Mr. Nelson, I just want to read—of the 16,000,000 tons of coal mined in Alabama, is this approximately correct as a distribution?

Mr. NELSON. Yes; that is the best of my information.

Mr. MARTIN. Of that amount there is about 5,000,000 tons that is consumed by the railroads?

Mr. NELSON. Yes.

Mr. MARTIN. About 5,000,000 tons consumed in the iron furnaces?

Mr. NELSON. Yes.

Mr. MARTIN. About 1,000,000 tons consumed for household purposes?

Mr. NELSON. And domestic coal.

Mr. MARTIN. And domestic coal, 5,000,000 tons, and for isolated electric plant water-pumping and similar operations, of which total of 16,000,000 tons approximately 8,500,000 tons are mined with power furnished by Alabama Power Co. from this source. Now, is it not also true that any interference with this continued supply of coal for these various public purposes would affect other industrial plants, the railroad transportation, and other public-utility uses?

Mr. NELSON. I don't see why it shouldn't Mr. Martin, if you shut off practically half of your power. You take the city of Birmingham. It gets all of its power for lighting and running its street cars from the Alabama Power Co., and the Birmingham Railway, Light & Power Co., supplying the city of Birmingham and operating the street car lines, supply a great number of manufacturing plants in and around Birmingham that are not direct customers of yours but are indirect customers.

The CHAIRMAN. Does the city of Birmingham get its light for its streets and for its residences from the Alabama Power Co.?

Mr. NELSON. Every bit of it.

The CHAIRMAN. If that were shut off and given to Mr. Ford and the city went in darkness for a while with the idea that the Government would pay you your damages, you would not care much, would you? Wouldn't you like to help out that much on Mr. Ford's philanthropic ideas?

Mr. NELSON. Well, not to-day.

The CHAIRMAN. You had better consider that seriously.

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Mr. NELSON. Gentlemen, it is just beyond my conception, with the tremendous big power plant at Sheffield that cost the Government $15,000,000, and being able to deliver coal there under the circumstances, just as cheap as you could deliver it at the Gorgas plant, why is it necessary to muddy up the waters down at the Gorgas plant? I am not against Mr. Ford getting Muscle Shoals. If he built up a big town there, as big as New York, it would benefit me.

The CHAIRMAN. It would be bigger than New York.

Mr. NELSON. I am a citizen of Birmingham, and anything that helps Birmingham helps me. I am interested in anything that Mr. Ford wants to do that will help our section, and I am not here to fight Mr. Ford, but this thing of taking the Gorgas plant and giving it to Mr. Ford is so preposterous that I see no use in the world to disturb something that should not be disturbed, but the negotiations should be confined to Muscle Shoals by Mr. Ford or anybody else. Now, I don't pretend to tell this committee whether they should let Mr. Ford or some one else have Muscle Shoals. You have information about various phases of the situation that I do not possess.

Senator HEFLIN. Mr. Nelson, you feel that you and other coal operators down there who are now being supplied with electric power from the Gorgas plant are entitled to have that power continued?

Mr. NELSON. Oh, I don't think there is any question about that, Senator.

Senator HEFLIN. That is the primary interest that you have in it?

Mr. NELSON. That is all the interest I am here to represent, and I think it is the duty of this committee, the Senate and the House to see that we get it. You can let Mr. Ford have Muscle Shoals, if you see proper.

Senator HEFLIN. If Ford gets Muscle Shoals and the coal operators can still get their electricity you would have a happy settlement of the situation?

Mr. NELSON. I hope so.

The CHAIRMAN. Remember, Mr. Nelson, that that answer to that question will be used, perhaps, later in a statement that you had advocated the giving of Muscle Shoals to Mr. Ford.

Mr. NELSON. Well, I don't want to make that statement, I am not at all conversant with all the facts touching Mr. Ford's offer for this Muscle Shoals proposition.

Senator MCKINLEY. The next thing that will be used will be the fact that Ford can sell you the power from Gorgas.

The CHAIRMAN. What rate do the people of Birmingham pay for electricity? I mean the ordinary householder, now. How much does he have to pay?

Mr. NELSON. Mr. Martin is more familiar with that than I.

The CHAIRMAN. You live there?

Mr. NELSON. Yes.

The CHAIRMAN. Do you know what you pay for your household electricity?

Mr. NELSON. No; I don't. The details I don't know.

The CHAIRMAN. Can you give that, Mr. Martin?

Mr. MARTIN. Yes, sir. It is 8½ cents per kilowatt hour, less 10 per cent discount for prompt payment.

The CHAIRMAN. Does that decrease as the volume increases?

Mr. MARTIN. Oh, of course. That is the highest rate. It decreases with the use.

Senator MCKINLEY. You pay 10 cents in Washington.

The CHAIRMAN. You get it for 19 mills cheaper than we get it in Washington?

Senator MCKINLEY. Twenty mills. You pay 100 mills per kilowatt, and they pay 80 mills per kilowatt, or 81.

The CHAIRMAN. You get it 2 cents per kilowatt hour cheaper?

Senator MCKINLEY. Yes. Then it grades down.

The CHAIRMAN. I was trying to find out what the ordinary person in the home would have to pay for electricity.

Mr. MARTIN. About 6 cents.

The CHAIRMAN. How much did you pay before you bought the electricity of the Alabama Power Co.?

Mr. NELSON. I used steam. I had a steam power plant.

The CHAIRMAN. I mean the citizens of Birmingham.

Mr. NELSON. I don't know.

Mr. MARTIN. In the first place, it has been reduced a cent and a half, as I recollect, per kilowatt hour since we came into Birmingham.

The CHAIRMAN. How did they get their electricity before you went in there?

Mr. MARTIN. By operating a big steam plant in the city of Birmingham.

Senator MCKINLEY. As a public utility, regardless of whether you want to make a contract or not, are you not required, under reasonable conditions, to furnish service to anyone that wants it?

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Mr. MARTIN. Yes; Senator. That is always a condition of the public utility act—that we must always hold ourselves in readiness to supply service. That is a part of the franchise under which we have developed electric power and under which we transmit power over the highways and exercise powers of eminent domain, and exercise franchises in general. The public service commission has jurisdiction to entertain a petition to require us to serve the public. Of this greatly increased amount of power that we must serve this year and next, I have not the slightest doubt that in two-thirds of the cases I mentioned this morning that want power, there is jurisdiction in the commission to require us to extend the service, and failure to extend the service subjects us not only to penalties, but to a possible forfeiture of our right to do business in the State.

Senator MCKINLEY. As I understand it, you have now practically 160,000 horsepower, and application for about 80,000 more?

Mr. MARTIN. Yes, sir; we have a connected load of 400,000 horsepower, and the peak is about 160,000. That is rather confusing evidence.

Senator MCKINLEY. You have a connected load of 400,000 horsepower?

Mr. MARTIN. Yes, sir. I testified when I was here before that our connected load was 370,000 last December. We have increased it 30,000 since December, and the load is going up every day.

The CHAIRMAN. What do you mean by connected load as distinguished from the power that you are delivering to somebody?

Mr. MCKINLEY. Describe it right in this room. You can do it right here. Here is a connected load, if we were to run all these lights. As a matter of fact, we run about one-fifth of them, but the connected load would be these two fans running and all the lights running. As a matter of fact, they are not running, but that would be the connected load. Is that right?

Mr. MARTIN. Yes, sir.

The CHAIRMAN. Do you mean that you own 400,000 horsepower?

Mr. MARTIN. No, sir.

The CHAIRMAN. I didn't think you did.

Mr. MARTIN. No, sir. It means that the coal mines, cement mills, cotton mills, and various industries have motors which, combined, total approximately 400,000 horsepower, which would be the demand on us if all were operating at one time.

The CHAIRMAN. If they all operated at one time you could not supply them, could you?

Mr. MARTIN. No, sir.

The CHAIRMAN. It would be like a bank. If all their depositors wanted their money at once they could not pay them.

Mr. MARTIN. In practice, Senator, we know that the load is going to run within certain limits.

The CHAIRMAN. Yes. You can not supply anything more than you actually have harnessed up.

Mr. MARTIN. That is correct; and there is a diversity factor in all lines of business, and that is the safety of this business—the diversity. We are able to connect up 400,000 load because we know that the demand on us at any one time will be approximately the same amount, and we supply the equipment to meet that demand, which, in the business, as Senator McKinley knows, we can forecast and keep up with. In other words, next year we know this connected load will be 500,000 horsepower.

The CHAIRMAN. For instance, the power you use in your cement mill which runs in the day time, won't be needed at night?

Mr. MARTIN. They run pretty nearly all the time.

Senator MCKINLEY. That is a different proposition. They are pretty near 100 per cent.

Mr. MARTIN. Yes, sir.

The CHAIRMAN. In a city like Birmingham the amount of electricity you supply during any 24 hours varies very greatly, does it not?

Mr. MARTIN. Yes, sir; from 35,000 to 40,000 horsepower of peak load in the day down to probably 8,000 horsepower at night.

Senator MCKINLEY. Here is another thing, Mr. Chairman. For instance, they are charging the lease consumer 81 mills. They would get some consumer like a great big power user and he would agree not to use any power during the peak load, and they make him a rate, maybe, of a fourth of that.

The CHAIRMAN. Yes.

Mr. MARTIN. I would just like to state, Senator, on the subject of rates, in 1921 our company received approximately 7½ mills per kilowatt hour for the power we sold. That gives you the great variety of industrial load and lighting load of 7½ mills as against a comparable figure in Ontario of 9.25 mills.

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STATEMENT OF MR. WILEY ALFORD, ATTALLA, ALA.

Mr. MARTIN. Mr. Alford, you reside at Attalla, Ala.?
Mr. ALFORD. Yes, sir.
Mr. MARTIN. What is your business?
Mr. ALFORD. Manufacturing plumbers' and steam fitters' supplies.
Mr. MARTIN. What is the name of your firm?
Mr. ALFORD. The National Pipe & Foundry Co.
Mr. MARTIN. How long have you been operating that company?
Mr. ALFORD. Since early 1916.
Mr. MARTIN. And you have a power contract with the Alabama Power Co.?
Mr. ALFORD. Yes, sir.
Mr. MARTIN. Now, Mr. Alford, your plant is electrified, is it?
Mr. ALFORD. Yes, sir.
Mr. MARTIN. And that is your only source of power?
Mr. ALFORD. Yes, sir; it is.
Mr. MARTIN. Will you just explain to these gentlemen what the result would be on your business if your source of power supply was interrupted wholly or for several months in the year?

Mr. ALFORD. If power was interrupted for one hour during any part of the year it would mean that our plant would have to close down completely. We have no other source of supply. The plant is driven by some 38 motors, ranging in size from one-half to 75 horsepower. If the plant were closed down, it would throw between 250 and 300 men out of work. These men are largely specialists in their line, and they would not drift into other industries, but would probably have to leave the State in order to find work during those periods of from three to four months each year.

Our product goes to practically every State in the Union and to Cuba, Mexico, Central and South America, the Philippines, and China. Not more than 2½ per cent of our product is used in Alabama. We are at the present time manufacturing goods to be used in the construction of dwellings, apartment houses, office buildings, and factories in about a dozen different States. We are also manufacturing another line of goods which is being used in the construction of steam plants for the supply of electric energy to public utility operations, and for oil companies operating in Louisiana, Texas, Oklahoma, and Tampico, Mexico. Fully 95 per cent of our costs is composed of expenditures made for raw materials and supplies produced in Alabama, and for labor. It can be seen very readily how far-reaching the effect would be if the operation of our plant were interrupted.

The condition which would be brought about with our company is not very different from the condition which would obtain with practically all of the industries in the State which the Alabama Power Co. serves. There would be a period of from three to sometimes five months during which those industries would have to close down, practically entirely, leaving a large part, possibly 75 per cent, of our factory operatives out of work. This, of course, would work a hardship on these people, would deprive them of their earning capacity, and would affect the farmers materially as it would curtail their market for their products. If the power were suspended from three to five months during the year we, of course, would figure on another source of supply, which would mean the installation of boilers and engines, thereby increasing our cost possibly threefold for that item alone.

The CHAIRMAN. How long have you been taking power from the Alabama Power Co.?
Mr. ALFORD. Since 1916.
The CHAIRMAN. Where did you get your power before that?
Mr. ALFORD. The plant was built in 1916.
The CHAIRMAN. You started right in with that?
Mr. ALFORD. Yes, sir.
The CHAIRMAN. You have never had any other source of supply?
Mr. ALFORD. No, sir.
The CHAIRMAN. How much power do you use?
Mr. ALFORD. In terms of horsepower or connected load?
The CHAIRMAN. Horsepower?
Mr. ALFORD. I think we use around 175 horsepower.
The CHAIRMAN. What is the value of your output per year?
Mr. ALFORD. I would put it at present as going about $720,000 a year.
The CHAIRMAN. How many employees do you have?
Mr. ALFORD. Between 250 and 300.
The CHAIRMAN. How much money is invested in your business?
Mr. ALFORD. About $250,000 in plant, in addition to working capital.

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The CHAIRMAN. How long a term is involved in your contract for power with the Alabama Power Co.?

Mr. ALFORD. I am not sure. I think it is 10 years. I think it has four more years to go.

The CHAIRMAN. Are you a stockholder in the Alabama Power Co.?

Mr. ALFORD. I have $600 of their preferred stock acquired in the last two months.

The CHAIRMAN. Are any members of your family or business associates stockholders in it, any of your firm or corporation?

Mr. ALFORD. No member of my family. I am not sure about my business associates; but I think not.

The CHAIRMAN. You want us to understand, do you, that the only interest you have in it is that you do not want any action taken that would interfere with the supply of power or would interfere with your contract which you have made with the Alabama Power Co.

Mr. ALFORD. I am interested, of course, in my own contract with the Alabama Power Co.—that is, my company's contract—and in anything that affects the State generally because if it affects it adversely, it affects me. I have interests in other sections of the State besides in Attalla.

The CHAIRMAN. Have you any interest in what disposition is made of Muscle Shoals proper?

Mr. ALFORD. No financial interest. I have a personal interest.

The CHAIRMAN. How far are you located from Muscle Shoals?

Mr. ALFORD. Across the country. I believe it is around a hundred miles.

The CHAIRMAN. How far from Birmingham are you?

Mr. ALFORD. About 52 miles.

The CHAIRMAN. Which way from Birmingham?

Mr. ALFORD. I am northeast of Birmingham.

The CHAIRMAN. If the Gorgas plant was eliminated from the Muscle Shoals question, you would not be interested in what disposition was made of it by the Government, would you?

Mr. ALFORD. Yes, sir; I would.

The CHAIRMAN. You would?

Mr. ALFORD. Yes, sir.

The CHAIRMAN. What do you want the Government to do with it?

Mr. ALFORD. I prefer that it be owned by strictly a public-utility concern.

The CHAIRMAN. You are in favor of the bill, then, probably that I have introduced. Have you examined that?

Mr. ALFORD. I have not examined that.

The CHAIRMAN. I would be glad to have you examine it. Do you believe it ought to be developed in the interest of the entire public?

Mr. ALFORD. Yes, sir.

The CHAIRMAN. And not given away to anybody?

Mr. ALFORD. No, sir.

The CHAIRMAN. Have you any questions of this witness, Senator Heflin?

Senator HEFLIN. What do you think about Mr. Ford's suggestion of using it to manufacture fertilizer, cheap fertilizers to the farmer? Don't you think it could be used that way and benefit more people than probably in any other way?

Mr. ALFORD. No, sir; I don't.

Senator HEFLIN. You would not use it for manufacturing fertilizers?

Mr. ALFORD. I think it could be used in part for the manufacture of fertilizer.

Senator HEFLIN. You are certainly against Mr. Ford's offer, then, are you not?

Mr. ALFORD. As it is; yes, sir.

Senator HEFLIN. What objection have you got to his offer as to Muscle Shoals if Gorgas were not included?

Mr. ALFORD. My objection is that Mr. Ford proposes to use the power to be developed at Muscle Shoals to supply industries in that immediate locality. I prefer that this project be developed and owned by a public utility company in order that the South, particularly the Southeastern States, and more particularly the State of Alabama, may be enabled to use the power to develop industrially along diversified lines. This power will be badly needed in the immediate future to serve industries already established which are being enlarged, to supply industries which will be established, and those which will be moved to Alabama from other sections of the country in order to take full advantage of the State's natural resources of which hydroelectric power is a very attractive one.

Mr. MARTIN. There are thousands of people in Alabama that feel just as you do about it, are there not?

Mr. ALFORD. I think there is no question about that, and that impression is growing rapidly.

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STATEMENT OF MR. S. H. DENT, MONTGOMERY, ALA., ATTORNEY FOR THE ALABAMA POWER CO.

The CHAIRMAN. State your name and occupation.

Mr. DENT. S. H. Dent, Montgomery, Ala. I am attorney for the Alabama Power Co. in the matter of the Warrior steam plant contract.

Mr. Chairman, there has been so much publicity with reference to the Muscle Shoals development and Mr. Ford's offer with regard thereto that I hesitate to consume the time of the committee on this subject. I am going to state at the outset that I shall simply present a synopsis of the points which I think sustain the validity of the contract between the Government and the Alabama Power Co. with reference to the plant, without elaborating the argument, simply stating the points so as to save time and I hope not to consume more than a few moments of the committee's time in doing that.

In order to state as briefly as possible the terms of the contract in so far as this proposition is involved, negotiations were begun between the Government and the Alabama Power Co. in the latter part of November, 1917, which led to the execution of the contract in question practically a year later, about November 8 or 9, 1918. The power company was approached by the Government on this subject through its former president, Mr. James Mitchell, who is now dead. When the President of the United States decided to construct nitrate plants at Muscle Shoals for the purpose of producing explosives during the war, the Ordnance Department began to look about for electric energy to be used during the period of construction and early operation, and the nearest power that they could get was the steam plant of the Alabama Power Co., at Gorgas, 88 miles south of Muscle Shoals. It was learned that the original plant of the power company, which was constructed prior to the beginning of the war, was not sufficient to supply this power to the Government and also to take care of its customers, many of whom were engaged in war industries. The result was that the Ordnance Department entered into an understanding with the Alabama Power Co., which was verbal at that time, and for which there was no legal authority at that time, to extend or enlarge their plant, practically double it—I believe a little more than double it—the Government to furnish the money and the construction to be made under the direction of the Alabama Power Co., supervised, of course, by Army officers. It is, of course well known that at that time no one could get any large sum of money for any such construction work, except the Government. Now, to come down to the terms of the contract——

The CHAIRMAN. Before you go to that, under this verbal agreement they went ahead with construction?

Mr. DENT. The Alabama Power Co. went ahead—I should have said that—under this verbal agreement, and in compliance with orders issued by the Ordnance Department that company proceeded with the construction or enlarging of its plant and building a transmission line to Sheffield, Ala.

The CHAIRMAN. That is, Muscle Shoals?

Mr. DENT. Muscle Shoals, perhaps better understood.

The CHAIRMAN. Was that constructed before the written agreement was made?

Mr. DENT. The construction work, as I understand, was practically complete before the written contract was entered into.

The CHAIRMAN. Now, then, they made a written contract?

Mr. DENT. The written contract was made by the terms of which, in brief, the Government was to furnish the money to enlarge the plant and build the transmission lines, and the company was to furnish power for the costruction and operation of nitrate plant No. 2 at a certain price.

The CHAIRMAN. I suppose that written contract was in reality carrying out the terms of the verbal contract that was made when the construction took place?

Mr. DENT. It was.

The CHAIRMAN. The written contract was simply putting in writing——

Mr. DENT. Putting in writing what had been understood between the power company and the Government in regard to the enlargement of this plant.

Under the terms of the contract the Government was authorized to retain a certain amount which it was required to pay for electric energy to the power company as what might be called a sinking fund for the purpose or repaying it for its investment in the enlargement of the power company's plant. The enlargement of the plant is connected directly with the original plant of the power company, and is upon the lands owned by it. The transmission line also is erected upon lands condemned or purchased by the Alabama Power Co. and which now belongs to that company, all of which was acquired prior to the act of April 11, 1918, authorizing the Government to acquire lands for munitions purposes.

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It was provided in the contract that the title to the property paid for with the money of the Government of the United States should remain in the United States and be treated as personalty.

Article 22 of the contract is the article providing for the sale of the enlarged plant by the Government to the Alabama Power Co. In short, this article expressly provides that at any time subsequent to three years after the termination of the war the United States shall have the option to sell the contractor, the power company, and the contractor shall, upon written demand of the United States, buy all its right, title, and interest in and to the Warrior extension and Warrior substation, with all rights appurtenant thereto at a value to be fixed by arbitration. It was further provided that the power company had a right to demand that the United States convey to it all of its right, title, and interest in said properties, at any time, provided the company would refund to the Government the amount of money it had expended.

This article further provides that the power company at any time after December 1, 1926, or such earlier period as the United States shall finally cease to take energy under this contract—and that is the condition of affairs now—may demand that the value of said properties be fixed by arbitration; and if the value so fixed is equal to or less than the amount of the so-called sinking fund to which I have referred, then the United States shall convey to the company all of its right, title and interest in and to said property. If the value fixed be greater than said fund, then the United States shall, upon payment by the contractor of the amount by which such value is greater than said fund, convey all of its right, title and interest in and to said property.

Subdivision 5 of article 22, about which so much has been said, provides that in the event that the contractor—that is, the power company—shall on demand of the United States fail or refuse to purchase the Warrior extension or Warrior substation, the United States may sell the same to another, but subject to the condition that the property shall not be operated but removed within six months after the sale has been consummated.

This subdivision of this article further provides that upon the consummation of such a sale with another purchaser the United States shall pay over to the contractor the whole of said accumulated funds less the amount, if any, by which the actual cost of said property shall exceed the price realized at such sale.

I mention this, Mr. Chairman, for the reason that in my opinion that clause in this subdivision of article 22 would enable the Government to recover from the power company the difference between the actual cost of its properties and the price that they received for same. That seems to have been overlooked by both the Attorney General and the Judge Advocate General.

Subdivision 7 of article 22 provides for the purchase of the transmission lines practically upon the same terms and conditions as applying to the extension and Warrior substation.

At this point, Mr. Chairman, I desire to direct particular attention to article 8 of the contract, which recognizes that the enlargement of this plant at the expense of the Government shall ultimately become the property of the Alabama Power Co. and shall be operated as a part of its system. That seems to have been overlooked by the Attorney General and the Judge Advocate General in their opinions.

This article provides that the contractor at its own expense, after the period of preliminary operation—which I understand to be the testing period of the plant, showing that it is capable of doing its work—shall maintain said plants, including all equipment, in first-class repair and in suitable condition for efficient and continuous operation. There is a clause in this article providing that in the event of damage to or destruction of the plants, the contractor, after the contractor begins to operate the same as a part of its system (that is, after the preliminary operation, using that language "as a part of its system") shall, at its own expense, promptly replace the property so damaged or destroyed. That expression "after the contractor begins to operate the same as a part of its system" is used in several places throughout the contract, showing the intention on the part of the parties to the contract, the Government and the power company, to be that this plant was to be erected at the expense of the Government but to be finally paid for by and become the property of the power company under the terms of the contract.

I may state that there are many other details in the contract, but I think it is not necessary to review them in so far as the point here involved is concerned.

Now we come to the objections that have been urged against the validity of the contract. All of these objections have been directed against Article XXII. It was first objected that the contract was invalid because it was dated December 1, 1917, when there was no act of Congress authorizing its execution. The facts are that it was not actually executed and delivered until about November 8 or 9, 1918, after

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the passage of the acts of May 10, 1918, and July 9, 1918, to which I will hereafter refer.

I have here papers showing that the board of review did not approve this contract until November 8, 1918, which is not necessary to put in the record.

Mr. MARTIN. It was approved first by the board of review, consisting of seven members, and on the same day it was approved in writing by seven members of that board, as shown by the photostat copy of their acts of approval, which are available.

Mr. DENT. Our contention in this connection, of course, is that the law governing the validity of a contract must be the law of the date of its actual execution and delivery, regardless of the date adopted by the parties.

The next objection urged was that the contract is in violation of the public policy declared in section 124 of the national defense act, which prohibited the Government in the construction and operation of nitrate plants from constructing or operating the same in conjunction with any private corporation: Mr. Martin has put into the record the facts showing that the plants at Muscle Shoals were constructed under war-time acts and not under section 124 of the national defense act. However, in addition to this it is perfectly manifest upon a reading of the contract that the Alabama Power Co. simply agreed to sell to the Government electric energy for the construction and operation by the Government of the plants at Muscle Shoals. The contract does not give the power company any voice whatever in the method or manner either of construction or operation of any of these plants. It might well be contended, because the Alabama Power Co. furnishes power to the Birmingham Street Railway that it is operating the street railroad in conjunction with the street-car company. Upon both of these points the Attorney General in his opinion overruled the Judge Advocate General's opinion, the Attorney General holding that the validity of the contract depended on the law of its actual date, and that section 124 of the national defense act had nothing to do with it. The Attorney General did hold, however, that Article XXII, in so far as it gave an option to the power company to purchase this enlarged plant and to arbitrate the price, was void. He bases his opinion upon the well-established principle of law that an agent with authority merely to sell has no right to give an option. We think that the opinion of the Attorney General has missed the mark entirely, because there is no question of agency involved in this contract. If the contract is valid at all, it is a contract between two principals—the Government on the one hand and the power company on the other. If the Government was authorized by any act of Congress to enter into the contract and the contract was entered into by officials authorized by law to make the contract, then the contract is the contract of the Government itself as principal. The Supreme Court of the United States has repeatedly held that the United States Government, within the sphere of its constitutional limitations, is as a body politic capable of making contracts just as any private corporation.

In this connection I would like to insert in the record so much of the act of July 9, 1918, to which I have referred, as bears upon this question. I do not quote the act of May 10, because the act of July 9 is practically the same as the act of May 10. The act of July 9 simply enlarged the powers contained in the act of May 10.

It is not very long, Mr. Chairman, and I will read it. The act reads as follows:

"That the President be, and he hereby is, authorized, through the head of any executive department, to sell, upon such terms as the head of such department shall deem expedient, to any person, partnership, association, corporation," etc., "any war supplies, material, and equipment, and any by-products thereof, any building, plant, or factory acquired since April 6, 1917, including the lands upon which the plant or factory may be situated for the production of such war supplies, materials, and equipment which during the present emergency may have been or may hereafter be purchased, acquired, or manufactured by the United States."

The CHAIRMAN. That was the act of July, 1918?

Mr. DENT. Yes, sir.

It will be observed that this act authorizes the President, through (not by) the head of any executive department, to sell, and to sell upon such terms as the head of such department shall deem expedient. In this connection I wish to state, without making the record too large, that subsequent to the passage of this act the Secretary of War issued a general order authorizing this act to be carried into effect through the heads of the various bureaus of the War Department (in this particular instance Major General Williams, of the Ordnance Department). The head of the bureau was authorized to make these sales subject to the approval of the Purchase, Storage, and Traffic Division of the General Staff. This particular contract was made through the Ordnance Department in accordance with the order of the Secretary of War and received the approval of the Purchase, Storage, and Traffic Division of the General Staff.

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I wish to call attention, Mr. Chairman, to the fact that the Attorney General in his opinion states in substance that the order of the Secretary of War authorizing these contracts to be made through the various departments with the approval of the Purchase, Storage and Traffic Division states that the order itself provides that the sale must be made for cash at public auction, overlooking the language of the order of sale as follows:

"Upon the receipt of such approval from the Director of Purchase, Storage and Traffic, such supplies as are intended for sale to persons, partnerships, and associations will then be disposed of, unless otherwise directed by the Director of Purchase, Storage and Traffic, for cash." "Unless otherwise directed," the Attorney General overlooked completely. In this case it was otherwise directed, because the contract was made in this form and received the approval of all the necessary officials of the War Department.

The CHAIRMAN. Did you appear before the Attorney General when he rendered this decision?

Mr. DENT. I did, Mr. Chairman. I appeared before the Attorney General and we discussed the law informally; but our whole argument was directed to a criticism of the Judge Advocate General's opinion, and this point was not raised. The Attorney General found this point after we left. He sustained us and overruled the Judge Advocate General. He decided this case, however, upon a point not suggested in the discussion there.

As I stated a few moments ago, all of the objections to the contract seem to be directed to article 22, which is the article providing that the Government may demand that the power company buy, on the one hand, and the power company demand that the Government sell, on the other, the additional equipment put upon the lands of the Alabama Power Co. at the expense of the Government during the war, the Judge Advocate General holding that article invalid for one reason and the Attorney General holding it invalid for another. We insist that article 22 is a binding and valid obligation, and stand ready to carry out our part of the contract.

However, we further insist, as a legal proposition, that if article 22 is stricken out of the contract as being entirely invalid and void, then the entire contract must fall; because this article can not possibly be severed from the other portions of the contract. If this be true, the Government would then be in the attitude of having entered upon the lands of the power company and placed valuable improvements thereon without any contract for the repayment of the money for the improvement or the removal of the property therefrom. Under the common law, which is the law of Alabama in this respect, the title of such improvements attaches to the soil and becomes the property of the owner thereof. We do not insist, however, upon any such construction of the contract.

There is one other act to which I desire to direct attention, and which I think would protect this contract, even if it was not executed in the manner provided by law. It is the act of Congress approved March 2, 1919 (40 Stat. L., p. 492), entitled "An act to provide relief in cases of contracts connected with the prosecution of the war, and for other purposes." I will read its important provisions:

"That the Secretary of War be, and he is hereby, authorized to adjust, pay, or discharge any agreement, express or implied, upon a fair and equitable basis that has been entered into in good faith during the present emergency and prior to November 12, 1918, by any officer or agent acting under his authority, direction, instruction, or that of the President, with any person, firm, or corporation for the acquisition of lands, or the use thereof, or for damages resulting from notice by the Government of its intention to acquire or use said lands, or for the production, manufacture, sale, acquisition, or control of equipment, materials, or supplies, or for services, or for facilities, or other purposes connected with the prosecution of the war, when such agreement has been performed in all or in part or expenditures have been made or obligations incurred upon the faith of the same by any such person, firm, or corporation prior to November 12, 1918, and such agreement has not been executed in the manner prescribed by law."

That act, Mr. Chairman, you perhaps remember, was passed at the instance of the Secretary of War. It was reported to the House Military Affairs Committee, as I happened to know at the time, that there were contracts amounting in value to something like $1,000,500,000 that had been entered into by the War Department during the war that did not conform to the statutory requirements, and Congress passed that act in order to relieve parties who in good faith had entered into these contracts with the Government. That act authorizes the Secretary of War to adjust, pay, or discharge contracts. I contend that the word "discharge" means to carry into effect, to fulfill a contract although it may not have been executed in the manner

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prescribed by law. In this connection I wish to make the further statement that it appears in the hearings before the House Military Affairs Committee, and I think it is a matter of common knowledge that the contract entered into between the Alabama Power Co. and the Government is similar in its general terms to contracts that were made both by the Army and the Navy during the war where the Government put increased facilities in some manufacturing plants owned by a private person or corporation. This was the usual form of contract adopted. Some provided that the Government could fix the price, and if the owner of the plant did not agree the Government would have to remove it. The contract in this instance, we contend, is fairer than any, because our contract compels us to pay the Government the fair value of the property which the Government at its expense put upon our land.

The act of July 9, 1918, I wish to say, because I know this of my own knowledge, was prepared in the War Department and sent to the Military Affairs Committee of the House with a request for early action. It was a rider on the Army appropriation bill of that year, along with other legislation requested by the Secretray of War, so that it is apparent that when the act of July 9, 1918, was drafted in the War Department, it was designed to meet just exactly this situation; that is to say, to take care of the form of contracts that were made by the War Department during the existence of the war, but which were at the time of execution authorized by law.

I should have stated in referring to the opinion of the Attorney General that article 22 not only gives the United States Government the right to demand that the Alabama Power Co. shall buy this property, but article 24, under the heading of "Arbitration," provides that any award, when signed by any two arbitrators, shall be final and conclusive upon both parties. So that it can not possibly be true, as stated by the Attorney General, as a matter of fact, that the Power Co. had the option to refuse to fulfill the award after the arbitration had fixed the price. The Attorney General evidently overlooked that feature of the contract.

Just one other point, Mr. Chairman, and then I am through.

In Mr. Ford's original proposition he called upon the Government to acquire the entire plant at Gorgas and turn it over to him. Before the Military Affairs Committee of the House—and I presume before this committee also—he subsequently amended his order so as to request that the Government simply assign to him whatever rights it may have in the Gorgas plant. We contended that this contract is not an assignable contract either at common law or under the terms of the contract itself, except as provided in article 23 of the contract. That article simply authorizes the Government——

The CHAIRMAN. That article is the one that authorizes the Government to sell to some one else if the Alabama Power Co. does not buy, is it?

Mr. DENT. No, sir. The article in regard to assignment is the article which authorizes the Government to assign to its successors at Muscle Shoals the right to take energy from the Alabama Power Co. just as it is. That is the only right that it can assign. If Mr. Ford should purchase the plant, then Mr. Ford could have assigned to him the right to make us give him electric energy during the period of the contract which, by the way, expires in 10 years. It provides, however——

The CHAIRMAN. It expires in less time than 10 years, does it not? Is it not in 1926?

Mr. DENT. Yes, sir.

The CHAIRMAN. That is less than 10 years.

Senator HEFLIN. Ten years from the time it was entered into.

Mr. DENT. Yes, sir.

That article further provides that the successor to the Government who desires to accept such assignment and transfer shall so signify in writing and shall thereupon be deemed to have accepted and assumed all the obligations of the United States under the contract in relation to the operations thereby assigned and transferred.

Mr. Ford in his proposition does not do that. On the contrary, the bill offered by the minority of the Military Affairs Committee of the House in section 12, providing for the assignment and transfer to the company of the rights of the Government in the Gorgas plant, contains this clause:

"But nothing in this paragraph shall be held to affect any question of the validity of any provision of the said contract."

He does not agree to accept the terms of the contract.

The CHAIRMAN. That that you have just read from that bill is an extract from Mr. Ford's offer?

Mr. DENT. Yes, sir; it is an extract from Mr. Ford's offer.

This article 23 further expressly provides, in the matter of assignment and transfer, that the right to assign and transfer shall not include the provisions of article 12. That is the article which gives the Government the right to demand that the com-

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pany buy and the company the right to demand that the Government sell. That is not assignable, by the express terms of that article.

Mr. Chairman, you referred to the provision of the contract, subdivision 5 of article 12. That authorizes the United States to sell the Warrior extension and Warrior substation in the event that the company shall fail or refuse to purchase on demand, as above stated.

The CHAIRMAN. Yes. That is in article 22.

Mr. DENT. In article 22; yes.

The CHAIRMAN. Is there any other provision in the contract that authorizes the Government to sell except that one?

Mr. DENT. None.

I believe, Mr. Chairman, that states the legal aspect of this question.

The CHAIRMAN. All right.

Mr. DENT. I want to promise you that I will not abuse the record by cumbering it, but when I correct my statement I would like possibly to add a little.

The CHAIRMAN. All right.

We will adjourn until 10.30 to-morrow morning.

(Thereupon, at 1.30 o'clock p. m., the committee adjourned to 10.30 o'clock a. m. Thursday, June 22, 1922.)

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MUSCLE SHOALS.

THURSDAY, JUNE 22, 1922.

UNITED STATES SENATE,
COMMITTEE ON AGRICULTURE AND FORESTRY,
Washington, D. C.

The committee met, pursuant to adjournment, at 10.30 o'clock a. m., in room 224, Senate Office Building, Senator George W. Norris presiding.

Present: Senators Norris (chairman), Capper, Ladd, Norbeck, McKinley, Smith, and Heflin.

The CHAIRMAN. The committee will come to order.

ADDITIONAL STATEMENT OF MAJ. J. H. BURNS, ORDNANCE DEPARTMENT, UNITED STATES ARMY.

The CHAIRMAN. Major Burns, I have called on you for certain information not only as to what is already in the testimony, so as to summarize it for us, but as to some other propositions that are probably not in the record that I have asked you to get data on. Are you now ready to report?

Major BURNS. Yes, sir. I have a summary of the Muscle Shoals project, in accordance with your instructions.

The CHAIRMAN. I would be glad to have you go on in your own way now and give it to the committee.

I will say to the committee I have not, of course, as the major knows, asked him to back up any proposition or anybody's ideas. I have asked him to get the cold facts as nearly as he can in relation to several things that we were somewhat in doubt about, and I have asked him also to summarize that the evidence shows—as you know he has been here all the time—so as to get it in a smaller space for the use of the committee and Members of Congress. I have not gone over his report myself, and the major will give us his conclusions just as he has reached them.

Senator HEFLIN. I have to be on the floor of the Senate at 11 o'clock and I want to ask him before he starts in with this statement if he agrees with Colonel Cooper as to the upkeep of Dam No. 2—$75,000 or $80,000 a year?

Major BURNS. The data that we have been able to obtain indicates that Colonel Cooper's estimate is low. We believe that——

The CHAIRMAN. I will just say if that is coming on in this report, Senator, you would not want him to go into it now, if he has got it in his order in the summary here, would you?

Senator HEFLIN. Except I wanted to question him.

The CHAIRMAN. That is one of the questions I asked him to look up for us.

Senator HEFLIN. You agree with him that it would cost that much or more to upkeep the dam?

Major BURNS. Yes, sir; that is correct. Unfortunately it is hard to get actual data, and it is more or less of an estimate as to what you should charge as the maintenance of the dam.

Senator LADD. Does it include, may I ask, the locks, or just the dam itself?

Major BURNS. Our figures includes only the dam. We have eliminated, in our estimate, depreciation and maintenance charges of the locks.

The CHAIRMAN. You have eliminated, also, the power house that Mr. Ford agrees to take care of?

Major BURNS. Yes, sir; and we have charged against the amount of money that is required to construct the dam itself, less the locks and power house, one-half of 1 per cent per year as the average yearly maintenance cost.

Senator HEFLIN. Your decision is that it would cost more than $75,000 a year to upkeep the Dam No. 2?

Major BURNS. Yes, sir.

Senator HEFLIN. Without the locks or power house or anything else?

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Major BURNS. Yes, sir. I want to say that it is a question of judgment, and I can not back it up with data.

Senator MCKINLEY. How many do you estimate?

Major BURNS. I can get that for you.

The CHAIRMAN. I would suggest to the members of the committee that the Major has arranged that in his own order here. I don't know where that comes in.

Senator HEFLIN. Let him go on in his own way. I just wanted to get that information before I had to go. That is as far as I want to go, so far as I am concerned.

The CHAIRMAN. All right, Major, go ahead.

Major BURNS. I have divided the Muscle Shoals project up into the following main headings: I, Description of present holdings; II, Utilization and sources of nitrogens; III, Navigation possibilities of Tennessee River; IV, Power possibilities of Muscle Shoals; V, Relation of Muscle Shoals to fertilizers; VI, Relation of Muscle Shoals to nitrogen preparedness in case of major war; VII, General summary; and VIII, Recommendations.

Each of these subjects will be discussed in turn.

I. Description of present holdings. The following framework is followed:

1. General subdivisions and control.

2. Nitrogen-fixation plants: (*a*) United States nitrate plant No. 1; (*b*) United States nitrate plant No. 2; (*c*) Gorgas power plant; (*d*) Warrior-Sheffield transmission line; (*e*) Waco quarry.

3. Development of Tennessee River: (*a*) Wilson Dam.

4. Summary of costs and salvage values of Government holdings at Muscle Shoals.

1. General subdivisions and control: The Government project at Muscle Shoals is divided into two main subdivisions: (1) Plants for the fixation of atmospheric nitrogen for use in munitions of war and in fertilizer; and (2) development of the Tennessee River from the standpoint of hydroelectric power and navigation.

All of the Muscle Shoals work has been conducted for the Government by the War Department. The plants for the fixation of nitrogen have been under the direct charge of the Ordnance Department of the Army, and the development of the Tennessee River has been under the direct charge of the Corps of Engineers of the Army.

For the fixation of nitrogen there have been erected nitrate plant No. 1 at Sheffield, Ala., and nitrate plant No. 2 at Muscle Shoals, Ala., together with the latter's adjuncts; namely, the Gorgas power plant located on the Warrior River at Gorgas, Ala., 90 miles south of Muscle Shoals; the Warrior-Sheffield Transmission Line, connecting this power plant with nitrate plant No. 2; and the Waco Quarry located near Russellville, Ala., about 26 miles south of nitrate plant No. 2.

For the development of the Tennessee River the Government has started the construction, at Muscle Shoals, of Dam No. 2, the official designation of which is the "Wilson Dam."

2. Nitrogen fixation plants—(*a*) United States nitrate plant No. 1: Construction of this plant was started under the authority contained in the nitrate supply section, or section 124, of the national defense act approved June 3, 1916. This act required especially that investigation be made as to the best means of producing nitrates for munitions of war and for fertilizers, and authorized the President to construct the necessary plants, both chemical and power, to put into effect the conclusions derived from such investigation.

After the passage of the act, the Secretary of War appointed several committees made up of prominent scientists and business men of the country to determine the best method to carry out the provisions of the act. Such committees finally recommended that a plant be erected for the fixation of nitrogen by the synthetic ammonia process. They recommended the General Chemical Co.'s modification of the German Haber process. This General Chemical process had not yet been established on a successful basis and only preliminary work thereon had been done. They also recommended that a plant be created for the oxidation of part of this ammonia into nitric acid.

The above program was followed in the construction and development of the plant, except that there was added to the program a plant for the concentration to a strength of about 97 per cent of a part of the nitric acid obtained from ammonia oxidation, the strength of which is about 50 per cent. There was also added a plant for the manufacture of ammonium nitrate to assist in supplying explosives required in the World War.

Construction was started in the late summer of 1917 and was essentially complete at the time of the armistice. Construction was in accordance with the agreement with the General Chemical Co. dated July 14, 1917, in which the General Chemical Co. allowed the Government use of its process without the payment of royalty if the production of the plant were used for munitions, or with the payment of a royalty of $5 per ton of fixed nitrogen if the production were used in fertilizer. The Judge Advocate

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General of the Army has held that this contract may be considered as terminated. He has likewise held in substance that there is no restriction on the Government in the sale of this property.

As the plant now stands it consists of a synthetic ammonia plant with a rated capacity of 30 tons of ammonia per day, a plant for the oxidation of part of this ammonia into nitric with a rated capacity of the equivalent of 45 tons of 100 per cent nitric acid per day, a plant for the concentration of the nitric acid so formed to a strength of some 97 per cent with a capacity of the equivalent of 12 tons of 100 per cent nitric acid per day, and a plant for the conversion of the ammonia and nitric acid into ammonium nitrate to a capacity of 22,000 tons of ammonium nitrate per year. There exists also a steam plant with a capacity of about 5,000 kilowatts. The nitrate plant contains 112 unfurnished permanent houses complete with furnaces, electric lightning and bathroom facilities; one unfurnished bachelor quarters of permanent construction with all improvements and containing accommodations for 35; 80 unfurnished temporary houses with no improvements (practically a construction camp); 8.6 miles of macadam roads; 8 miles of sewers; 4½ miles standard gauge railroads; water plant and other necessary auxiliaries. The site consists of about 1,900 acres.

In the development and operation of the plant great difficulty was encountered in the synthetic ammonia process, and this part of the endeavor was not a success. It was made to work periodically for a few days at a time, but it always broke down. The remainder of the plant, however, was tested out and is successful and can be depended upon to produce its rated capacity of satisfactory material.

It should be realized, however, that this was the pioneer plant in America for the fixation of nitrogen by this process and it is hardly fair to expect that it should have worked thoroughly satisfactorily in its initial effort. The experiences gained at this plant have undoubtedly been of great benefit to the Atmospheric Nitrogen Corporation, an affiliated company of the General Chemical Co. and subsidiary of the Allied Chemical Corporation, which has been successful in the design, construction, and operation of a 10-ton ammonia plant following this general process located at Syracuse, N. Y.

The Ordnance Department has made quite extended studies for the purpose of reconstructing this plant so that it could be expected to satisfactorily operate. The Ordnance Department believes that such an objective can be accomplished. To reconstruct it upon the smallest scale that will give commercial knowledge, or approximately 2 tons of ammonia per day, and to operate it for a period of about six months in order to establish the success of the plant would cost approximately $1,250,000. To reconstruct the plant so that it would be capable of producing its rated capacity, or 30 tons of ammonia per day, and to operate it for a short period in order to establish it upon a successful operating basis, would cost approximately $4,000,000. To install the necessary sulphate of ammonia plant which would be required if its product were to be made available to the fertilizer trade, would cost approximately $750,000 additional.

A description of the synthetic ammonia process of fixing nitrogen and the probable costs of manufacture are included in the chapter on "Sources of nitrogen and processes of fixing atmospheric nitrogen."

The plant is at present in standby condition awaiting decision as to its disposition. Standby expenses are some $25,000 to $30,000 per year.

In round numbers the cost to the Government of the plant was $13,000,000, divided as follows:

United States nitrate plant No. 1.

Chemical plant		$7,134,785.00
Oxidation plant	$1,706,976.63	
Soda-recovery plant	6,256.10	
Process plant	4,216,854.85	
Neutralization plant	109,978.56	
Coal and coke storage	35,651.76	
Gas plant	551,591.18	
Concentration plant	289,083.20	
Ammonium nitrate plant	218,390.72	
Shops		314,076.00
Machine shop	97,624.51	
Storehouse	140,686.72	
Oil house	2,492.81	
Warehouses	73,271.96	
Power house		1,271,665.23
Land		615,127.20

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Village		$2,526,276.28
Permanent village	$1,597,978.26	
Temporary village	928,298.02	
Public works		1,026,011.60
Roads and walks	36,663.00	
Sewer system	212,297.33	
Water system	496,323.81	
Railways	179,438.58	
Electric distribution system	101,288.88	
Total		12,887,941.31

The War Department does not believe that this plant is necessary for the achievement of munitions preparedness.

The estimated salvage value of this plant as scrap only is $600,000. This assumes that practically no parts of the plant would be sold on the basis of their being used in present location and that it would be necessary to practically demolish the plant and and then sell parts with value to the highest bidder. The figure of $600.000 represents about 3½ per cent of the cost of the project plus $150,000 for the land. This figure has been developed from the Ordnance Salvage Board experience in salvaging war plants, with due consideration of the special character of the equipment. If appreciable parts of the plants could be used in present location the salvage value should correspondingly increase.

Senator NORBECK. When you speak of $150,000 for the land, that is the land and and these residences on it?

Major BURNS. No, sir, That is the land only. We figure that the land could be sold for $150,000. We are assuming you would have to scrap the houses.

Senator NORBECK. You are figuring the houses in the other salvage?

Major BURNS. Yes, sir. Of course, if you could sell the village as a going village and get people to live in it, you could undoubtedly get more than we are stating here.

The CHAIRMAN. That is nitrate plant No. 1?

Major BURNS. Yes, sir.

Senator MCKINLEY. Four and three-quarter million dollars it would take to put it into operating shape?

Major BURNS. As a fertilizer plant, yes, sir.

(*b*) United States nitrate plant No. 2: This plant is a war plant constructed under the authority of war appropriations for the purpose of assisting in meeting the demands for explosives which were developed by World War requirements. It was designed to produce the high explosive ammonium nitrate, which was in turn to be combined with another high explosive, or T. N. T., produced in other plants of the country. This combination, which was called amatol, was loaded into high explosive shells as the bursting charges thereof.

Ammonium nitrate is formed by the combination of ammonia and nitric acid. During the war there was a serious shortage of ammonia and a shortage was feared in Chilean nitrate, from which nitric acid is ordinarily manufactured. The No. 2 plant was designed to fix the nitrogen of the air into the form of ammonia and then to convert this ammonia into nitric. It was, therefore, able to assist in relieving the shortage that existed in ammonia and at the same to reduce by a very considerable amount the quantity of nitrate of soda which must be imported from Chile.

The American Cyanamid Co. had been operating for several years the only successful nitrogen fixation plant on the American Continent. This company had been using the cyanamid process of nitrogen fixation. The Government, therefore, in order to be sure of supplying its needs, selected this process and contracted with this company for the design and operation of the necessary plant. This company, in turn, organized the Air Nitrates Corporation as a subsidiary for the purpose of carrying out the contract with the Government. The final contract required the company to not only construct and operate plant No. 2, but also to construct and operate two additional nitrate plants, Nos. 3 and 4, the combined capacity of which would have been equivalent to the capacity of United States nitrate plant No. 2.

The contract paid to the company a construction fee dependent upon the cost of construction and in addition operating fees and royalty fees for the use of its process during the war and royalty fees only for the use of its process after the termination of the war. These latter royalties amount to $30 per ton of nitrogen fixed. There is also a contract with the Air Reduction Co. which grants to that company for the use of its process in extracting nitrogen from the air by the liquid air process royalties to the extent of $2.72 per ton of nitrogen fixed. All royalty fees terminate about 1931.

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The contract with the Air Nitrate Corporation provides also that such corporation has the privilege of purchasing the plant upon as favorable terms as the United States is willing to accept from any other bidder.

The plant consists of a calcium carbide plant, including necessary facilities for burning limestone and preparing coke, a plant for the extraction of nitrogen from air by the liquid air process, a plant for the welding together of calcium carbide and nitrogen to from cyanamid, a plant for the conversion of cyanamid into ammonia, a plant for the conversion of half of the ammonia so formed into nitric acid, and a plant for the combination of nitric acid and ammonia for the formation of ammonium nitrate. The plant has a capacity of 475 tons of calcium carbide per day, 600 tons of cyanamid per day, 150 tons of ammonia per day, the equivalent of 260 tons of 100 per cent nitric acid per day, and 300 tons of ammonium nitrate per day or 110,000 tons of ammonium nitrate per year. The capacity of this plant is five times the capacity of United States nitrate plant No. 1. It contains a 60,000-kilowatt steam plant which is able to supply about 75 per cent of the power requirements of the plant. It contains 186 permanent houses with electric lights, sewers, and water supply (practically unfurnished); 1 hotel with 100 rooms with modern improvements and furnished; 366 temporary housing facilities; 22.3 miles of improved roads; 37 miles of standard gauge railway; 20 miles of sewers; 16 miles of domestic and fire water supply; a 60,000,000-gallon reservoir together with necessary filtering and pumping plant; and a 50-ton per day ice plant. The site consists of 2,300 acres.

Construction was started in the early spring of 1918 and was substantially complete at the time of the armistice, except the 60,000 kilowatt steam plant. This latter was not completed until over a year later, although if it had been necessary it would probably have neen completed in the spring of 1919. The test run of the chemical plant was made in the spring of 1919, which definitely proved that the plant is capable of producing at least its rated capacity of thoroughly satisfactory material. The steam plant was also proven satisfactory by a test run.

The cost of the plant in round numbers amounted to some $66,500,000 divided as follows:

United States nitrate plant No. 2.

Chemical plant		$35,984,090.55
Raw material and storage group	$2,809,361.53	
Carbide group	5,768,305.82	
Cyanamid group	4,987,045.31	
Liquid air group	4,005,503.09	
Ammonia gas group	3,710,872.79	
Nitric acid group	12,627,103.80	
Ammonium nitrate group	1,236,075.39	
Process steam plant	559,577.74	
Laboratory	280,245.08	
Shops		2,696,481.30
Engine terminal and machine shops	937,049.35	
Blacksmith shop	187,284.30	
Woodworking shop	168,202.88	
Warehouse	567,662.53	
Switch house	495,772.14	
Foundry	90,650.64	
Gate building	249,859.46	
Power house		12,326,392.23
Land		237,711.00
Village		3,121,193.31
Ice plant	166,312.32	
Permanent dwellings	1,984,120.64	
Temporary dwellings	(1)	
Hospital	142,877.97	
First quarters hotel	586,924.89	
Soldiers' barracks	240,957.49	
Public works		8,843,007.62
Roads and walks	583,201.94	
Sewer system	1,132,606.80	
Water system	2,265,452.59	
Railways	2,025,478.13	

[1] Temporary buildings, the cost of which was $5,174,377.19, have been allocated to the cost of the per manent plant as overhead.

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Public works—Continued.		
Trolley lines	$173,393.99	
Fencing	107.641.25	
Telephone system	22,555.46	
Electric distribution system	2,532,677.46	
Inventories (approximately one-half of these inventories have not been disposed of)		$3,043,516.20
Muscle Shoals substation [2]		189,843.99
Total		66,442,236.20

The plant is at present in stand-by condition and is being held by the War Department as a reserve plant for the assurance of an adequate supply of nitrogen in time of need. It is now costing at the rate of about $100,000 a year to finance the caretaking force. This sum does not, however, cover the replacements that will undoubtedly be necessary after several years retention. This cost is covered in chapter "Relation of Muscle Shoals to Munitions Preparedness." The 60,000-kilowatt steam plant is under lease to the Alabama Power Co. which company must maintain such plant in good condition. It must also pay to the Government stand-by rental of $10,000 per month, and in addition two mills for each kilowatt hour of energy that is generated by the plant.

In the terms of military preparedness, this plant is capable of fixing atmospheric nitrogen sufficient for the complete supply thereof of 12 divisions organized, equipped, and fought in accordance with conditions in existence at the time of the Armistice in 1918. Proper nitrogen preparedness at the present time requires that this plant be retained in available condition for fixing nitrgoen for munitions purposes.

The CHAIRMAN. How many men in a division?

Major BURNS. It is a variable quantity of approximately 40,000.

The CHAIRMAN. And this you say will supply 12 divisions?

Major BURNS. Yes, sir. It will supply about enough nitrogen, in round numbers, for a half million men.

The CHAIRMAN. All right.

Senator NORBECK. Does that half million mean men in the field in actual service?

Major BURNS. It means 12 divisions with all their auxiliary troops. The figure of 40,000 men to a division includes a combatant force of about 20,000 men and a noncombatant force of the same number. These latter are engaged in supply work of one kind or another.

Senator NORBECK. It means an Army in actual work, part of which is on the fighting line?

Major BURNS. That is correct. It means an Army of about 500,000 men, about half of whom are continuously on the battle front. As another indication, during the World War we mobilized about 4,000,000 men but we actually got on the firing line as combatant troops only 750,000 men, and those 750,000 men represented 30 divisions. So this plant would supply the nitrogen for nearly half as many divisions as we were able to fight in the World War.

The CHAIRMAN. How much additional money would be required to put that plant in shape to make fertilizer? As I understand it, when you get about so far in your process in making explosives, if we are going to make fertilizer we would branch off in a different direction, and this plant is not now equipped to make it.

Major BURNS. That is correct. If you were going to make ammonium sulphate it would require an additional expenditure of about three and one-half million dollars for the sulphate plant.

The CHAIRMAN. It would take, then, about three and a half million dollars to equip this plant for the fertilizer business?

Major BURNS. It would take between three and a half and four million dollars, because in addition to the sulphate plant there would have to be erected some storage warehouses, etc.

Senator MCKINLEY. Well, do you use that raw ammonium sulphate for fertilizer?

Major BURNS. Yes, sir; that goes into——

Senator MCKINLEY. It goes into making fertilizer.

Major BURNS. And in some cases they use it directly on the soil.

The salvage value of this plant as scrap only is estimated at $7,250,000. This estimate is likewise a result of Ordnance Salvage Board experience in selling war plants. This assumes that practically none of the plant could be used in present location and that plant would have to be practically demolished and salable parts

[2] Located on Government-owned land at Muscle Shoals, Ala.

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disposed of to highest bidder. This amounts to about 11 per cent of cost. It is not believed that this percentage could be achieved except for the large quantity of platinum that goes with the plant and the large quantities of construction and other easily salable material available including four sulphuric-acid units. From the standpoint of an operating concern, it would be worth only what it could be made to earn a reasonable return upon. With present knowledge it is not believed that the cyanamid plant could be operated with a profit of power should cost in excess of 1 mill per kilowatt hour. Even at this price the margin would be so slight that it would be more or less negligible. However, certain parts of the plant might be operated at a profit. This seems to be true in the case of the 60,000-kilowatt steam plant, and it is believed that this plant might be disposed of for some $6,000,000.

The most advantageous method of salvaging the No. 2 plant would be to sell all parts possible on basis of operating concern and balance on basis of scrap. In this way it might be possible to obtain a return of some $11,650,000 or some 18 per cent of cost.

(c) Gorgas power plant: United States nitrate plant No. 2 requires for its full operation approximately 80,000 kilowatts of power. Part of this was to be supplied by the 60,000 kilowatt steam plant of nitrate plant No. 2 and part by the 30,000 kilowatt plant which was constructed by the Government as an addition to the already existing 20,000 kilowatt plant of the Alabama Power Co. located on the Black Warrior River, Gorgas, Ala.

It was realized when the No. 2 plant was started that the development of the required power plant would require a longer time than the development of the chemical plant proper. It was also desirable that an appreciable amount of power be available at an early date for construction purposes as well as for the initiation of operations. The Alabama Power Co. was the only large producer of power in the near vicinity of Muscle Shoals and therefore was the only company capable of delivering to the Government at an early date the quantity of power necessary. A contract was therefore entered into between the Ordnance Department and the Alabama Power Co. providing for an early delivery of power to be made by that company and providing further for the construction and operation by that company of a 30,000 kilowatt extension to their already existing Gorgas plant, which would assure to that company sufficient capacity to meet the added demand of the Government,

This contract provided in substance that this extension would be constructed by the Alabama Power Co. upon land belonging to the Alabama Power Co. at the expense of the United States. The contract provided also for the Alabama Power Co. to operate this plant and to supply power therefrom or from its system at certain definite figures outlined in the contract. In case the power plant was operated for the benefit of the Alabama Power Co. only, that company was to pay certain rentals to the United States for such use. The contract provides also that the plant would be sold to the Alabama Power Co. within a certain limit after the proclamation of peace at a price to be fixed by a board of arbitrators, and provided further that in case such sale could not be consummated the plant would be removed from the land of the Alabama Power Co. The contract does not permit the Government to assign its rights in the matter of sale of this property.

Construction was started early in 1918 and was essentially completed at the time of the armistice. Power was available to the Government at an earlier date than this, however, from the Alabama Power Co.'s system.

As already stated, the plant was constructed as an addition to the already existing plant of the Alabama Power Co. The Government unit and the Alabama Power Co. unit are both under the same roof. The Government unit has its own apparatus for supplying coal, its own apparatus for disposing of ashes, its own boiler plants, its own generating plant, and its own switchboard. The trackage is mutually owned. The water supply is mutually owned. The distribution system for taking the power from the switchboard is mutually owned. The steam boiler capacity of the Government unit is sufficient to take care of the generating capacity of from 50,000 to 60,000 kilowatts. The generating unit has a capacity of 30,000 kilowatts. In addition to the power plant there was constructed a substation with necessary control apparatus sufficient to take care of 66,000 kilowatt capacity. There was also constructed a short railroad called "The Drifton Extension" for the purpose of connecting this site with commercial railways. Housing facilities, etc., sufficient to accommodate some 35 white families and 11 colored families were also constructed.

The cost to the Government, in round numbers, amounted to $3,850,000, divided as follows: Power plant, $3,417,702.70; Warrior substation, $383,756.35; Drifton Railroad, $50,421.94; total, $3,851,880.99.

This plant is now under lease to the Alabama Power Co. in accordance with the contract existing with such company. The company must maintain the plant and

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pay to the Government 1½ mills for each kilowatt hour of energy generated. This is producing a yearly return to the Government of some $75,000 to $100,000 per year.

The salvage value of this plant as scrap only amounts to some $800,000. However, the contract with the Alabama Power Co. requires that this plant should be sold on basis of operating concern, in which case it has a salvage value in the neighborhood of $3,000,000.

The CHAIRMAN. You said that the plant cost three million and something. I thought the cost was four million and something.

Major BURNS. I was speaking only of the Gorgas plant proper. You are thinking of both the Gorgas plant and the transmission line.

The CHAIRMAN. I always consider the transmission line and the Gorgas plant together.

Major BURNS. When you add the cost of the transmission line, the total is about $4,800,000, as I recall it.

(*d*) Warrior-Sheffield transmission line: For the purpose of connecting nitrate plant No. 2 with the Alabama Power Co.'s transmission system and the Gorgas power plant, there was constructed by the Alabama Power Co. under contract with the Government the Warrior-Sheffield transmission line. This line is approximately 90 miles in length. It is constructed upon land owned or controlled by the Alabama Power Co. The contractual obligations between the contractor and the Government are substantially the same with reference to this transmission line as they are with reference to the Gorgas power plant.

Its cost to the Government amounted, in round numbers, to $960,000.

This line is at present under lease to the Alabama Power Co., as a part of the agreement for the utilization of the steam plant at nitrate plant No. 2. The power company is required to maintain and guard the transmission line.

Its salvage value on basis of scrap only is $60,000. However, the contract with the Alabama Power Co. likewise requires that this transmission line be sold on basis of fair value as going concern in which case its value amounts to some $675,000.

The CHAIRMAN. It is your judgment, then, that the Gorgas power plant plus the transmission line, its fair value would be something over $3,000,000?

Major BURNS. Yes, sir. I am submitting the figures that were submitted by the Chief of Ordnance with reference to the salvage value of these plants. When the offer of the Alabama Power Co. came in a short time ago, or two and a half million dollars for all this property, we checked up the value of it more thoroughly in accordance with present market conditions, and I believe as a result of that check that the $3,675,000 which we had in our original report is high. I think, though, that the minimum figure is at least $3,000,000. That would amount to some five-eighths of its war-time cost.

The CHAIRMAN. It would be a little over 60 per cent.

Major BURNS. Yes, sir; a little over 60 per cent of its war-time cost.

(*e*) Waco quarry: For its successful operation, nitrate plant No. 2 requires a very large quantity of high-grade limestone. The daily consumption at the plant is some 1,200 tons of limestone. This, in turn, requires the quarrying of approximately 2,000 tons per day, inasmuch as the "fines" which are developed in the crushing plant can not be economically used in the manufacture of calcium carbide. The Waco quarry has been sufficiently explored to assure a sufficient quantity of high-grade limestone to supply the No. 2 plant for in excess of 50 years.

There is installed at the Waco quarry a crushing plant and the necessary facilities for its operation. A small part only of the quarry face has been opened up. A railroad has been constructed for the purpose of connecting the quarry with the nearest commercial railway. This branch is 1½ miles in length. A few small houses have been constructed to house the operating force. The site consists of about 450 acres.

The quarry is now in stand-by condition and has one caretaker. It costs some $2,500 per year to maintain it.

Its salvage value on basis of scrap only is $102,000 and on basis of operating concern $375,000. It is quite doubtful that it could be disposed of on latter basis.

The cost to the Government of the quarry amounted, in round numbers, to $1,300,000.

3. Development of Tennessee River—(*a*) Wilson Dam: The data with reference to Wilson Dam has been taken from the testimony of Colonel Barden.

Construction of the Wilson Dam, sometimes called Dam No. 2, was ordered by the President on February 23, 1918, under the authority contained in section 124 of the national defense act. All the money spent on the dam is from that fund. There has been a total allotment to the dam of $17,159,610.42, of which $16,890,507.45 had been expended or obligated as of April 1, 1922, leaving on that date an available balance of $269,102.96. The dam is one-third completed.

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The dam is divided into three parts—the lock on the right bank of the river; the spillway dam, which occupies the northerly three-fourths of the river bed; and the power house, which continues the dam to the left or south bank of the river. The total length, bank to bank, is approximately 4,500 feet. The dam section is 2,890 feet long, and the power-house section 1,184 feet. The remaining distance, or 326 feet, is taken up by the lock and abutment connections.

There are two locks in tandem—that is, one below the other—each 300 feet long by 60 feet wide, with 7½ feet on the miter sills and a lift of 45½ feet, or a total of 91 feet for both. The upper lock will be spanned at its upper end by a bascule bridge, carrying the highway across it from the north bank to the concrete arch bridge, which spans the remainder of the entire structure.

The spillway dam is composed of two sections—the nonoverflow and the overflow or spillway section. The former, adjacent to the lock, is only 180 feet long, extending to the original bluff line, where it connects with the spillway section. Both sections are nonreinforced gravity structures, surmounted, as already stated, by a concrete arch bridge. The spillway section provides for the regulated discharge of excess water over the crest by means of 63 controlling gates in order to maintain the pool above the dam at a fixed elevation. The pool extends upstream to the site of the proposed No. 3 Dam, a distance of 14.7 miles, and will have a surface area of 14,037 acres. The total height from the river bed to the top of the gates or pool elevation is 97 feet. The roadway is some 20 feet higher. The foundations extend 15 to 16 feet into the bedrock. The width of the dam at the bedrock is 101 feet, and the apron 59 feet wide, making a total width of 160 feet. The maximum head of water on the turbines will be 96 feet and the minimum 68 feet.

The power-house section is pierced by three penstocks for each generating set, each about 12 by 16 feet in size, which carry the water to the turbines. The electrical transformer and distributing apparatus will be located on the bluff overlooking the power house. A railway will be built, terminating beneath the cranes of the power house, and an ice and trash fender will extend from the north end of the power house to the south bank of the river. Four turbo-generator units have been ordered and parts thereof have already been delivered. The water turbines are capable of developing 30,000 horsepower each. The generators are 25,000 kilowatts, 12,000 voltage. Arrangements are included in the designs for a total installation of 18 units.

Gauge readings have been taken on the river almost continuously over a 50-year period. The lowest gauge readings, which occurred in 1904, give a minimum power of 71,800 horsepower. The maximum horsepower has been in excess of 1,100,000. The following table gives the quantity of power available for the percentages of time indicated: 87,300 horsepower, 99.4 per cent of the time; 100,000 horsepower, 97 per cent of the time; 141,000 horsepower, 83.3 per cent of the time, or 10 months; 205,000 horsepower, 66⅔ per cent of the time, or 8 months; 306,500 horsepower, 50 per cent of the time, or 6 months; 600,000 horsepower, 20 per cent of the time, or 2½ months, 1,100,000 horsepower, 7 per cent of the time, or five-sixths month.

If equipped with the complete 18 units, the total cost of the Wilson Dam would amount to $45,500,000, or an additional expenditure of some $28,500,000. If equipped with 8 units, the cost would be some $40,300,000 or an additional expenditure of some $23,200,000. If equipped with 4 units, the total cost would be some $37,800,000, or an additional expenditure of some $20,800,000.

The corps of engineers believes that it would take approximately three years to complete this dam.

No work is at present being done on the dam. There is a small force for guarding and maintenance purposes.

It is estimated that construction facilities and particularly the cofferdams and temporary structures of all kinds are depreciating at a rate of approximately $400,000 per year, exclusive of the interest return that might be obtained from a completed structure. In other words, suspension of work is costing the Government a minimum of $400,000 a year from the standpoint of deterioration alone. This figure does not take into consideration, however, the possible lower construction costs that may have been or be developed by reduction in costs of labor, materials, and freight.

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4. Summary of costs and of salvage values of Government holdings at Muscle Shoals.

Item.	Approximate cost.	Salvage value.		
		As operating concern.	As scrap.	As operating concern and scrap.
United States nitrate plant No. 1	$13,000,000	[1] None.	$600,000	$600,000
United States nitrate plant No. 2	66,500,000	[2] $6,000,000	7,250,000	[3] 11,640,000
Gorgas plant	3,850,000	3,000,000	800,000	3,000,000
Warrior-Sheffield transmission line	950,000	[4] 675,000	60,000	675,000
Waco Quarry	1,300,000	357,000	102,000	357,000
Wilson Dam	17,000,000	[5]	[5]	[5]
Total	102,600,000	10,032,000	8,812,000	[5] 16,272,000

[1] None, with possible exception of power plant.
[2] None, unless the Wilson Dam is completed, with the exception of 60,000 kilowatt steam-electric power plant which has value of possibly $6,000,000. The value of United States nitrate plant No. 2 as an operating concern depends mainly upon the price which must be paid for power for its operation. If power is to cost $0.004 per kilowatt-hour the plant has practically no earning power and therefore has no value. However, if power can be obtained at $0.001 per kilowatt-hour, the plant has an earning capacity and corresponding value.
[3] Basis of steam plant as operating concern and balance of plant as scrap.
[4] Seventy-five per cent of cost.
[5] It is estimated that present-day replacement value of work already done on Wilson Dam amounts to some $12,000,000, or about three-fourths of its war-time cost.

II. Utilization and sources of nitrogen. The following framework is followed:

1. Utilization of nitrogen: (*a*) For military explosives; (*b*) for fertilizers; (*c*) for industrial purposes.

2. Sources of nitrogen: (*a*) Organic nitrogen; (*b*) inorganic nitrogen (1) Indian and Chilean nitrate; (2) by-product coke ovens; (3) nitrogen fixation plants—arc process, cyanimid process, direct synthetic ammonia process.

3. Prices of nitrogen: (*a*) Average yearly prices (wholesale) for principal inorganic nitrogen materials used in fertilizers; (*b*) cyanimid process; (*c*) direct synthetic ammonia process—water-gas hydrogen; electrolytic hydrogen; (*d*) arc process; (*e*) summary of costs of fixing nitrogen.

4. Conclusions as to costs of fixing nitrogen in competition with ammonia sulphate and Chilean nitrate.

Utilization and sources of nitrogen: The following chart outlines the quantities of nitrogen utilized over a period of years and the sources from which such nitrogen has been taken. This chart includes only inorganic nitrogen and does not give figures for organic nitrogen.

Consumption and supply of inorganic nitrogen in United States 1902–1920.

Year.	Consumption.				Supply.			
	Agriculture.	Industries.	Military.	Total.	Chilean nitrate.	By-product ammonia.	Fixed atmospheric nitrogen.	Total.
1902	14,600	28,200	1,500	44,300	34,900	9,400	.....	44,300
1903	18,300	37,900	1,500	57,700	47,400	10,300	.....	57,700
1904	17,600	33,400	1,500	52,500	39,700	13,000	.....	52,700
1905	23,400	45,500	1,500	70,400	55,800	14,400	.....	70,300
1906	29,000	52,400	1,500	82,900	64,300	18,400	.....	82,700
1907	33,400	54,700	1,500	89,600	63,500	25,800	.....	89,300
1908	32,700	45,000	1,500	79,200	54,200	24,875	.....	79,175
1909	44,100	61,550	1,500	107,150	73,800	33,100	.....	106,900
1910	59,900	77,550	1,500	138,950	92,600	45,550	500	138,650
1911	65,900	77,250	1,500	144,650	94,500	48,060	1,000	143,560
1912	63,700	71,500	1,500	136,700	84,300	51,500	1,800	137,700
1913	77,750	92,750	1,500	172,000	108,500	58,500	5,100	172,100
1914	87,700	68,000	1,500	157,200	94,300	58,300	4,200	156,800
1915	70,700	93,000	35,000	198,700	133,800	58,600	5,700	198,100
1916	73,000	93,200	113,800	280,000	211,800	61,700	6,500	280,000
1917	88,100	93,400	166,000	347,500	268,000	68,900	10,600	347,500
1918	85,800	94,800	231,100	411,700	322,500	77,900	11,300	411,700
1919	92,000	86,100	14,200	192,300	81,000	80,000	12,900	173,900
1920	210,000	115,000	1,500	320,500	230,000	105,000	15,000	350,000

1 ton of nitrogen is equivalent to—
5.7 long tons of Chilean nitrate (or 6.4 short tons).
4.9 tons of ammonium sulphate.
4.5 short tons of cyanamid.
2.8 short tons of ammonium nitrate.

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1. Utilization of nitrogen (*a*) for military explosives: Almost without exception all military explosives are nitrogen compounds. Owing to the slight affinity between nitrogen and the other elements with which it enters into combination, many of its compounds are unstable and can be decomposed with the almost instantaneous evolution of heat and gas.

Black powder, the original military explosive, and practically the only one up to some 30 years ago, has as one of its three constituents a nitrogen compound, saltpeter. Since 1890, however, nitration processes have been developed until now practically all modern explosives are made by treating various bases with nitric acid—for instance, smokeless powder from cotton and nitric acid; picric acid from carbolic acid and nitric acid; trinitrotoluene (T. N. T.) from toluol and nitric acid; fulminate of mercury from mercury and nitric acid; and ammonium nitrate from ammonia and nitric acid.

(*b*) For fertilizer: For plant growth, too, nitrogen in a chemically combined form in the soil is essential. Originally land was fertilized by placing back on it the animal and vegetable refuse of the farm, but this material, though of excellent quality, is not usually of sufficient quantity. As chemical knowledge has developed, however, study has shown that these organic or animal and vegetable materials can be supplemented by inorganic or mineral materials. As a result, practically all complete commercial fertilizers now contain, besides some form of organic nitrogen, a very considerable quantity of inorganic nitrogen, as well as the phosphoric acid and potash, also necessary for plant growth.

The requirement of nitrogen for fertilizer, though usually considered as a peace-time requirement, might be even more a war-time requirement, for while the population to be fed might not be reduced, available labor for the farms would be much reduced not only through enrollment in the Army but also through employment in munitions and war plants. The acreage under cultivation is therefore reduced, necessitating an increase in yield per acre. This can only be accomplished by using in addition to all possible labor-saving farm machinery, as much fertilizer and therefore as much nitrogen as possible.

(*c*) For industrial purposes: Nitrogen is also needed in many of the important chemical industries of the country. It is as necessary for commercial as for military explosives. Commercial explosive, such as dynamite, blasting powder, and the like, are used not only for practically all mining and quarrying operations, but to a rapidly increasing extent for road building, clearing land, digging ditches, and in other operations as a means of saving labor.

Nitrogen as nitrate is necessary, too, for the comparatively new and rapidly developing nitrocellulose product industry, which includes the manufacture of artificial leather, now almost universally used for automobile upholstery; of photographic films; of imitation ivory; and of all forms of celluloid. Nitrogen in this form is also needed for the manufacture of dyes, for the manufacture of sulphuric acid, and for the manufacture of a large part of our glass.

Nitrogen as ammonia is necessary for cold-storage plants and for the manufacture of artificial ice; it is found in nearly every home as household ammonia; and it is necessary for the production of several of the staple chemicals, including soda ash, which next to sulphuric acid is probably the most important commercial chemical; cyanide is used in extracting gold from its ores, and in insecticides.

2. Sources of nitrogen—(*a*) Organic nitrogen: The organic nitrogen from waste animal and vegetable materials is limited in amount and now can supply but a part of the fertilizer requirements. Almost no organic nitrogen goes into either military or other nonagricultural uses. The organic nitrogen materials include the animal and vegetable refuse of the farm, dried blood and tankage from the slaughterhouse, cottonseed meal from the oil mills, fish scrap, leather scrap, and similar materials. These were originally used almost entirely for fertilizers, but as many of them can be used to much better advantage as feed, they are being diverted more and more to that use, with the result that the present inadequate supply of these materials available for fertilizer is not only not keeping pace with the growth in the demand but is actually diminishing.

As an indication of the relations existing between organic and inorganic nitrogen in commercial fertilizers, the following table is inserted. The data have been consolidated by the Ordnance Department from data obtained from Agricultural Department, from Federal Trade Commission, and other available sources.

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Nitrogen consumed in commercial fertilizer in the United States.

Year.	Nitrogen.			Per cent of organic nitrogen to total nitrogen.
	Organic.	Inorganic.	Total.	
	Tons.	*Tons.*	*Tons.*	
1899	38,000	8,000	46,000	82
1904	48,000	16,000	64,000	75
1909	49,000	43,000	92,000	53
1914	80,000	88,000	168,000	47
1919	62,000	92,000	154,000	40

(*b*) Inorganic nitrogen: The inorganic, or mineral nitrogen, comes from three sources, each of which now normally supplies about equal quantities of the world consumption. These, in the order of their development as sources of supply, are the natural nitrate beds of India and Chile, and the by-product coke ovens, and the plants for fixing the nitrogen of the air.

(1) Indian and Chilean nitrate: For several centuries nitrate has been extracted from the soil of India and shipped as saltpeter to Europe and to this country. However, since their development, which began about 1830, the nitrate fields of Chile have been the world's chief source of supply of inorganic nitrogen, the production of India being insignificant in comparison. Even in spite of the tremendous development of the other two sources of inorganic nitrogen in the last few years, Chile still normally supplies about a third of the world's inorganic nitrogen requirements and nearly half of those of this country.

In addition to supplying nitrates for fertilizers, this source of nitrogen has been of great value to the world in the development of the chemical industry, as Chilean nitrate has been the substance out of which practically all of the nitric acid that the world consumed until starting of the World War was manufactured. As a result of the World War developments, however, we are now able to manufacture nitric acid out of ammonia, and our complete dependence upon Chile is therefore stopped.

The definite quantity of nitrate avilable in Chile is unknown. Various estimates have been made as to what its continuing life will be and these vary from 40 years to three or four centuries. It seems reasonable to believe, however, that the Chilean beds can continue to furnish nitrate at the rate of 3,000,000 tons per year for an additional century at least.

(2) By-product coke ovens: The next source of supply to assume importance was the by-product coke oven, by means of which the nitrogen contained in bituminous coal is recovered when the coal is coked. The by-product coke oven, as an important source of nitrogen supply, is a more recent development than the utilization of the nitrate beds of Chile, and even though to some extent outstripped in the last few years by the rapidly increasing number of plants for the fixation of atmospheric nitrogen, it now normally supplies about one-third of the world's inorganic nitrogen requirements and nearly half of those of this country.

By-product coke ovens were developed by the Germans and were first introduced into America about 1893. From that time until 1914, when the World War started, development was such that only 25 per cent of the coke used in the United States was coked therein. Since 1914 the increase has been quite rapid. The growth was developed during 1915 and 1916 by purchase by the Allies of the by-products at high prices. In 1917 and 1918 the Ordnance Department, in order to obtain increased supplies of ammonia and toluol, or two of the by-products, further speeded up construction. As a result of all these efforts the country is at the present time coking in by-product coke ovens about 60 per cent of all its coke. The further development of this industry is very much to be desired.

Whereas in manufacturing coke by the old beehive method there was produced only some 0.65 of a ton of coke, the by-product ovens will produce approximately 0.72 of a ton of coke or 10 per cent more from 1 ton of coal and in addition the following surplus by-products: 6,000 cubic feet of gas, 10 gallons of coal tar, 3 gallons of light oils, 5 pounds of ammonia. In general these by-products are worth about one-half as much as the coke.

(3) Nitrogen fixation plants: The other important source of nitrogen supply, the one most recently developed and the one most rapidly growing is the nitrogen fixation plant in which the nitrogen of the air is fixed to some other element or elements and

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thus converted into usable form by means of one of the several chemical and electrochemical processes. This source will undoubtedly have to be developed as the main hope of supply for the future. Although the first commercial nitrogen fixation plant started operating only 16 years ago, there are now some 40 plants located in 12 different countries, which together normally supply about a third of the world's nitrogen requirements. The United States has lagged behind in this development. Less than 2 per cent of our present normal requirements can be supplied from plants operating in this country, and even if the idle Government plant at Muscle Shoals were to be operated it would supply only an additional 19 per cent, still leaving us with only a fifth of our nitrogen from fixation plants. If to this we add the 7 per cent which can be supplied by the Canadian plant of an American company, we still lag behind the rest of the world, as all these plants can furnish only little more than a quarter of our requirements.

Processes of nitrogen fixation: At the present time there are many processes differing greatly in principle for fixing atmospheric nitrogen and these processes are in various stages of development ranging from those used in commercial plants which have been producing for years to those which have been tried on only a little larger than a laboratory scale. There are three processes, however, which have been commercially utilized; the arc process, the cyanamid, and the synthetic ammonia, sometimes termed the Haber process.

The arc process: The first process to be utilized commercially was the arc process, still the simplest and most direct one.

In this process the nitrogen and the oxygen, both present in the air, are combined to form nitric oxide by being heated together to a high temperature by means of an electric arc. After quick cooling the gases contain a small percentage of nitric oxide which, on further cooling, combines with additional oxygen of the air, to form nitrogen dioxide. This nitrogen dioxide is then passed through large towers over which water or weak acid is trickling, and combining with more oxygen from the air is absorbed by the water forming dilute nitrtic acid.

There are several types of arc furnaces used but these differ only in mechanical and electrical construction, the principle of all being very much the same.

It will be noted that the only raw materials used in this process are air and water. The power requirements, however, are so large, about 67,000 kilowat hours per ton of nitrogen fixed, that this process can be used in its present state of development only where very cheap water power is available. For this reason this process has not been as extensively used as either the cyanamid or direct synehetic ammonia process. Its principal development has been in Scandinavia, although comparatively small scale plants have been built in other countries. At present less than 10 per cent of the world's supply of nitrogen fixed from the air comes from plants using the arc process.

The cyanamid process: The next process, the commercial development of which started almost at the same time as that of the arc process, is the cyanamid process.

In this process burned lime and coke are combined in the intense heat of the electric furnace to form calcium carbide. This carbide, after cooling, is finely ground, placed in closed ovens in an atmosphere of pure nitrogen, obtaining by the fractional distillation of liquid air, and heated to a yellow heat. The nitrogen combines with the carbide to form calcium cyanamid. The crude calcium cyanamid is again finely ground and any carbide remaining, destroyed by treating with water.

Details especially of the equipment used in the several steps of the cyanamid process differ considerably in the different plants throughout the world but the essential principles are the same in all.

This process requires air, water, limestone, coke, and coal as its principal raw materials. Its electric power requirements, about 15,000 kilowatt hours per ton of nitrogen fixed, are so much less than those of the arc process that it is not nearly so dependent as that process on unusually cheap water power. Further, its intermediate product, the crude calcium cyanamid, is used to a considerable extent directly as a fertilizer material, even though there are limitations to its wider use. Two of its possible final products, ammonia sulphate and ammonium phosphate, are better fertilizer materials than those obtainable from the arc process.

For these reasons the cyanamid process is the most generally used of any of the fixation processes, there being more than 20 plants in 10 different countries, including the large Government plant at Muscle Shoals, Ala., now idle, and a smaller plant located in Canada but owned by an American company. At present, under normal conditions, somewhat more than a third of the world's fixed nitrogen comes from plants using the cyanamid process. There is no cyanamid plant now operating in the United States but practically all of the product of the Canadian plant is im-

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ported into this country, constituting about 7 per cent of our total inorganic nitrogen supply.

This process is now in an advanced state of development.

Direct synthetic ammonia process: For some few years the arc and the cyanamid processes had the field to themselves. In 1913, however, the direct synthetic ammonia process developed by Doctor Haber was utilized on an industrial scale. In this process pure nitrogen and hydrogen, subjected to high pressure and high temperature, unite in the presence of a catalyst to form ammonia.

The nitrogen can be obtained from the factional distillation of liquid air, and the hydrogen from the electrolytic decomposition of water. Ordinarily, however, this mixture of the two gases can be more cheaply prepared by the Bosch process utilizing a mixture of water gas and producer gas.

This process varies very considerably in the different plants in which it is used, the differences being principally in the method of preparing the nitrogen-hydrogen mixture and in the special catalyst and the pressure used for the ammonia synthesis. For instance, the Claude process is based upon an opertaing pressure of approximately 1,000 atmospheres; the Haber process is based upon an operating pressure of approximately 200 atmospheres; the General Chemical Co. process is based upon an operating pressure of approximately 100 atmospheres. The Casale process is apparently based upon an operating pressure of 300 atmospheres. It makes use of electrolytic hydrogen.

The direct synthetic ammonia process requires air, water, and coke, as well as certain chemicals, as its raw materials. Its power requirements, provided the Bosch process is used for obtaining the nitrogen-hydrogen mixture, are much lower than even those of the cyanamid process, being only about 4,000 kilowatt hours per ton of nitrogen fixed. If hydrogen is obtained by the electrolysis of water, the power requirements are approximately 18,000 kilowatt hours per ton of nitrogen fixed, or one-third more than in the case of the cyanamid process. The engineering difficulties in safely handling these gases at high temperatures and pressures are very considerable, and in its present state of development a much more skilled personnel is required to operate this process than either the arc or the cyanamid processes.

The synthetic ammonia process has been developed almost entirely in Germany, and during the latter stages of the war was the most important source of her nitrogen supply. It was not until the last year, 1921, when at Syracuse, N. Y., the first plant of any size outside of Germany using this process came into regular production. Though the Government had built a synthetic plant at Sheffield, Ala., during the war, it had not come into regular operation before the end of hostilities, when it was shut down. Experimental plants with only a very small production have been operated in France and Italy, and a commercial plant is how under construction in England. But the German plants up to this time have supplied all of the nitrogen fixed by this process, and their capacity is so great that in a normal year they furnish more than half of the world's supply of fixed air nitrogen. The plant at Syracuse, N. Y., has only about one-hundredth of their capacity and can supply less than 2 per cent of the total inorganic nitrogen requirements of the United States.

3. Prices of nitrogen: During the last few decades, in which the consumption of nitrogen has increased so tremendously, there has been no pronounced price trend, either up or down. There have been marked variations from year to year, but the average price over a period of years has varied but little. It is believed that the reason for this has been the stabilizing effect of the elastic supply of Chilean nitrate, which in the past has set and still sets the price for the other sources of inorganic nitrogen.

The cost of the nitrogen recovered as a by-product in the coke ovens is largely a matter of bookkeeping, and the coke ovens will make and sell their nitrogen for whatever it will bring, keeping their price low enough to insure a demand for their entire output. For this reason a country's requirements will first be supplied from this source. The requirements in excess of this supply will, generally speaking, be filled by the fixation plants as far as their capacity permits, and providing that they can meet the selling prices of Chilean nitrate. Any deficiency in the supply still remaining will be met by importing sufficient Chilean nitrate. There are exceptions, of course, to this general rule, as certain uses require particular forms of nitrogen best supplied from one particular source, but, broadly speaking, Chilean nitrate supplies the last portion of the demand, and for this reason, in accordance with usual economic experience, it fixes the price for the other two sources.

The price of Chilean nitrate tends to stabilize itself over a period of years because of the flexibility of output. There has been no marked change in the last few decades in the cost of producing Chilean nitrate, since increased efficiency of operation has been offset by rising labor costs and by the fact that the richer deposits are becoming exhausted.

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The following tables give the costs of Chilean nitrate and of by-product coke-oven ammonia in the form of ammonium sulphate over a period of years, and estimated costs of fixing nitrogen in the form of ammonia or its equivalent by various fixation processes. These latter estimates are the work of the Ordnance Department and while, they have been worked out as carefully as possible, it must be appreciated that they are not based upon actual commercial operating experience and may, therefore, be somewhat in error. In comparing prices, it should be remembered that fixed nitrogen in usable form is the all important consideration. And inasmuch as the various substances do not contain the same percentages of fixed and usable nitrogen, it is necessary to convert them to the same standard, which is believed to be a ton of nitrogen.

Average yearly prices (wholesale) for principal inorganic nitrogen materials used in fertilizers.

Year.	Price of material.			Price per ton of nitrogen in material.		
	Nitrate of soda per 100 pounds.	Sulphate of ammonia per 100 pounds.	Cyanamide per unit of ammonia.	In nitrate of soda (15.6 per cent nitrogen).	In sulphate of ammonia (20.6 per cent nitrogen).	In cyanamide (18 per cent nitrogen).
1900	[1]	$2.87	.....	.....	$279.00	.....
1901	[1]	2.76	.....	.....	268.00	.....
1902	[1]	2.98	.....	.....	289.00	.....
1903	[1]	3.12	.....	.....	303.00	.....
1904	[1]	3.11	.....	.....	302.00	.....
1905	[1]	3.12	.....	.....	303.00	.....
1906	$2.36	3.10	.....	$303.00	301.00	.....
1907	2.45	2.96	.....	314.00	287.00	.....
1908	2.27	2.95	.....	291.00	286.00	.....
1909	2.14	2.80	.....	274.00	272.00	.....
1910	2.12	2.64	[1]	272.00	256.00	.....
1911	2.15	2.85	[1]	276.00	277.00	.....
1912	2.44	2.99	[1]	313.00	290.00	.....
1913	2.32	2.92	$2.17	298.00	283.00	$264.00
1914	2.12	2.69	2.15	272.00	261.00	261.00
1915	2.33	3.25	2.06	299.00	315.00	250.00
1916	3.18	3.78	2.08	480.00	367.00	253.00
1917	4.05	5.87	2.88	519.00	570.00	350.00
1918	4.68	6.71	3.21	600.00	651.00	390.00
1919	3.61	4.56	[1]	463.00	443.00	.....
1920	3.52	6.15	[1]	451.00	597.00	.....
1921	[2] 2.54	[2] 2.41	[1]	326.00	234.00	.....

[1] Data not readily available. [2] For first nine months only.

Figures for sulphate of ammonia for 1900–1906 are from Coal Gas Residuals, by Fred H. Wagner.

Figures for nitrate of soda for 1906–1912 and for sulphate of ammonia for 1907–1912 are from Federal Trade Commission Report on Fertilizer Industry, and are, respectively, prices in New York and at plant.

Figures for all materials for 1913–1918 are from War Industries Board Price Bulletin No. 48, Prices of Fertilizers, and are New York prices for nitrate and sulphate and Niagara Falls prices for cyanamid.

Figures for 1919–1921 are from Oil, Paint, and Drug Reporter, and are for nitrate of soda price in New York, and for sulphate of ammonia price at plant except when in 1919 and 1920 there were no price quotations at plants and export prices were used.

Figures include export tax by Chilean Government on nitrate of soda amounting to $11.39 per short ton.

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Construction and production cost comparison per ton fixed atmospheric nitrogen.

(B) CYANAMID PROCESS.

CONSTRUCTION COSTS.

Per annual ton of nitrogen fixed as crude cyanamid $450
Per annual ton of nitrogen fixed as ammonia 500

PRODUCTION COSTS PER TON OF NITROGEN FIXED AS CRUDE CYANAMID.

	Based on power at 1 mill per kilowatt-hour.		Based on power at 4 mills per kilowatt-hour.	
	Cost.	Per cent of total.	Cost.	Per cent of total.
Raw materials	$50.64	27.3	$50.64	22.2
Power, 14,600 kilowatt-hours	14.60	7.9	58.40	25.4
Labor	37.44	20.2	37.44	16.3
General expense	15.24	8.2	15.24	6.6
Capital charges [1]	67.50	36.4	67.50	29.5
Total per ton	185.42	100.0	229.22	100.0

PRODUCTION COSTS PER TON OF NITROGEN FIXED AS AMMONIA.

	Based on power at 1 mill per kilowatt-hour.		Based on power at 4 mills per kilowatt-hour.	
	Cost.	Per cent of total.	Cost.	Per cent of total.
Raw materials	$57.52	27.9	$57.52	23.0
Power, 14,700 kilowatt-hours	14.70	7.1	58.80	23.5
Labor	43.22	20.9	43.22	17.2
General expense	15.66	7.6	15.66	6.3
Capital charges	75.00	36.5	75.00	30.0
Total per ton	206.10	100.0	250.20	100.0

[1] NOTE.—Capital charges, taken at 15 per cent of construction costs, include interest, depreciation, and mortization, taxes, and insurance, etc.

(C) DIRECT SYNTHETIC AMMONIA PROCESS.

CONSTRUCTION COSTS.

Per annual ton of nitrogen fixed as ammonia using water-gas hydrogen as at United States nitrate plant No. 1 ..... $610
Per annual ton of nitrogen fixed as ammonia using electrolytic hydrogen 485

PRODUCTION COSTS PER TON OF NITROGEN FIXED AS AMMONIA FROM WATER-GAS HYDROGEN (HABER-BOSCH METHOD).

	Based on power at 1 mill per kilowatt-hour.		Based on power at 4 mills per kilowatt-hour.	
	Cost.	Per cent of total.	Cost.	Per cent of total.
Raw materials	$39.60	18.2	$39.60	17.2
Power, 4,500 kilowatt hours	4.50	2.1	18.00	7.9
Labor	30.07	13.8	30.07	13.1
General expense	51.48	23.6	51.48	22.1
Capital charges [1]	91.50	42.3	91.50	39.8
Total per ton	217.15	100.0	230.65	100.0

[1] NOTE.—Capital charges, taken at 15 per cent of construction costs, include interest, depreciation and amortization, taxes and insurance, etc.

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Construction and production cost comparison per ton fixed atmospheric nitrogen—Con.

(C) DIRECT SYNTHETIC AMMONIA PROCESS—Continued.

PRODUCTION COSTS PER TON OF NITROGEN FIXED AS AMMONIA FROM ELECTROLYTIC HYDROGEN.

	Based on power at 1 mill per kilowatt-hour.		Based on power at 4 mills per kilowatt-hour.	
	Cost.	Per cent of total.	Cost.	Per cent of total.
Raw materials	$11.09	6.9	$11.09	5.3
Power, 18,000 kilowatt hours	18.00	11.2	72.00	33.5
Labor	17.63	10.9	17.63	8.3
General expense	41.55	25.8	41.55	19.3
Capital charges	72.75	45.3	72.75	33.6
Total per ton	161.02	100.0	215.02	100.0

(D) ARC PROCESS.

CONSTRUCTION COSTS.

Per annual ton of nitrogen fixed as nitric acid $700

PRODUCTION COSTS PER TON OF NITROGEN FIXED AS DILUTE NITRIC ACID.

	Based on power at 1 mill per kilowatt hour.		Based on power at 4 mills per kilowatt hour.	
	Cost.	Per cent of total.	Cost.	Per cent of total.
Raw materials, labor, and general expense	$100.00	37.8	$100.00	22.5
Power 60,000 kilowatt hours	60.00	22.6	240.00	53.9
Capital charges [1]	105.00	39.6	105.00	23.6
Total per ton	265.00	100.0	445.00	100.0

(E) SUMMARY OF PRODUCTION COSTS OF FIXING 1 TON OF NITROGEN IN FORM OF AMMONIA BY FOLLOWING PROCESSES.

Process.	Based on power at 1 mill per kilowatt hour.	Based on power at 4 mills per kilowatt hour.
Cyanamid	$206.10	$250.20
Haber-Bosch	217.15	230.65
Haber-electrolytic	161.02	215.02

[1] NOTE.—Capital charges, taken at 15 per cent of construction costs, include interest, depreciation and amortization, taxes and insurance, etc.

Senator MCKINLEY. Will these figures that you have there give us, so that the layman will understand, the comparative cost of making sulphate of ammonia down there as compared with the cost of Chilean nitrate?

Major BURNS. Yes, sir. I am going to give you that later. I will summarize it.

Senator MCKINLEY. It will be in the record?

Major BURNS. Yes, sir.

Senator MCKINLEY. So that we can read there and show that Chilean nitrate will cost $50 a ton and that the same product worked out down there will cost $40 a ton, or whatever it is?

Major BURNS. I will read it to you, Senator, and if it does not supply you with the desired information, I will change it so that you will be satisfied.

4. Conclusions as to cost of fixing nitrogen in competition with ammonium sulphate and Chilean nitrate: In comparing the cost of nitrogen by the fixation processes with

the costs of nitrogen in nitrate of soda and ammonium sulphate, it should be remembered that it costs some $60 to $80 per ton of nitrogen to convert it from the form of ammonia into the form of ammonium sulphate.

In other words, after you get ammonia, in order to make it available for fertilizer you have to combine it with something, and that combination costs you some $60 to $80 per ton of nitrogen. And ammonium sulphate is to-day the only developed and operating commercial method of making ammonia available in fertilizers. In addition there must be added interest charges on the operating capital required to produce the material and to carry it until it is paid for. This capital amounts to about one year's product, and interest would amount to some $15 per ton of nitrogen.

The maximum average yearly price per ton of nitrogen during the period 1900 to 1914, inclusive, from either nitrate of soda or sulphate of ammonia is $313. The minimum average yearly price is $256. The average yearly price per ton of nitrogen in both nitrate of soda and sulphate of ammonia over the above period is $283 per ton. The price has held very steady during this entire period, as can be seen from the table. To-day's price is about $281 per ton, as against the pre-war average of $283 per ton.

A study of the ability of the three processes of nitrogen fixation or the cynamid, the Haber-Bosch, and the Haber electrolytic, indicates as follows:

The cyanamid process with 1-mill power could produce ammonium sulphate at a cost of some $291.10 per ton of nitrogen as compared with the 1900 to 1914 average price of $283. In other words, such a plant could not break even on 1-mill power. It could hardly live if power cost nothing. The Haber-Bosch process with 1-mill power could produce ammonium sulphate at a cost of $302.15 per ton of nitrogen as compared with the 1900–1914 average of $283. It could not break even in the fertilizer field if power cost nothing. Both might live in the anhydrous ammonia market, where the price of nitrogen is higher.

The Haber electrolytic process with 1-mill power could produce ammonium sulphate at a cost of $246.02 per ton of nitrogen, or $37 less than 1900–1914 average. On a basis of 2-mill power the cost would be $264 per ton of nitrogen, or $17 less than 1900–1914 average. On basis of 3-mill power the cost would be $281, or $2 less than 1900–1914 average.

It seems fair to conclude from the above that, with present knowledge, the cyanamid process and the Haber-Bosch process can not be expected to reduce the price of ammonia nitrogen in fertilizer if used in form of ammonium sulphate. In fact, they could not break even with power at the very low cost of 1-mill per kilowatt hour. The Haber electrolytic process can produce nitrogen in the form of ammonium sulphate at a price about equal to the 1900–1914 average with power at three mills per kilowatt hour. With every reduction of one mill per kilowatt hour in power (other things remaining equal) the margin would be increased by $18 per ton of nitrogen, or about 6.3 per cent of the average pre-war selling price.

If phosphoric acid could be produced sufficiently cheaply to compete with acid phosphate and such phosphoric acid were combined with the ammonia, all the processes could compete with Chilean sodium nitrate and in fact develop quite a saving in the cost of nitrogen to the farmer. On the basis of 1-mill power the cyanamid process reduce the price of nitrogen by $42 per ton or some 14 per cent. This results from the elimination of the cost of sulphuric acid—taken at $50 per ton of nitrogen. With 3-mill power this reduction would be $12 per ton, or 4 per cent. On basis of 1-mill power Haber-Bosch process could reduce price of nitrogen by $30.85 or 11 per cent. With 3-mill power reduction would be $17.25 or 6 per cent. On basis of 1-mill power Haber electrolytic process could reduce price of nitrogen by $87 per ton or 31 per cent. On basis of 3-mill power reductions would be $51 or 18 per cent.

The CHAIRMAN. That depends on something. What is that condition?

Major BURNS. That condition is cheap phosphoric acid. As a matter of fact, the crux of the whole fertilizer possibility of Muscle Shoals hinges not so much on nitrogen as it does on phosphoric acid. If this process spoken about to you by Mr. Swann and Doctor Whitney, namely, production of cheap phosphoric acid by electric-furnace methods, could be developed as a real commercial proposition for the fertilizer trade, then Muscle Shoals has quite material possibilities in the way of reducing the price of fertilizer.

The CHAIRMAN. That is something yet undeveloped.

Major BURNS. Yes; that is something undeveloped, but, as you will recall. Mr. Swann——

The CHAIRMAN. As I understand it, they have a strong probability that it can be developed.

Major BURNS. That is correct, but it is not yet a proven thing.

The CHAIRMAN. No; not yet demonstrated.

Major BURNS. That is correct.

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The CHAIRMAN. All right.

Senator MCKINLEY. These figures just kind of confuse. Don't you give in some place what your power will cost?

Major BURNS. I will give that later on, and will tie that in so that you will see it.

Senator MCKINLEY. You might just as well say one-half cent. You are not going to get any for that.

Major BURNS. When we get to the power end we will show that on the basis of 4 mills for primary power, 2 mills for the cream of secondary, and 1 mill for the short time secondary, the No. 2 dam is an excellent power proposition. You will have to use your judgment as to what kind of power will be used and what you will charge for it. I believe, myself, that some 90 per cent of the work can be done with secondary power and that the balance should be provided for with primary power. I think a fair average charge would be 2 mills per kilowatt hour.

III. Navigation possibilities of the Tennessee River (data from testimony of Colonel Barden). The following framework is followed:

1. General description of Tennessee River.

2. Navigation facilities (*a*) French Broad and Holston Rivers; (*b*) Tennessee from Knoxville to Chattanooga; (*c*) Tennessee from Chattanooga to Hales Bar; (*d*) Tennessee from Hales Bar to Browns Island; (*e*) Tennessee, Muscle Shoals section; (*f*) Tennessee, Florence to mouth.

3. Cost of development of navigation over Muscle Shoals section.

4. Conclusions as to development of navigation over Muscle Shoals section.

1. General description of Tennessee River: The Tennessee River is formed by the junction at a point about 4½ miles above Knoxville, Tenn., of the French Broad River, rising in western North Carolina, and the Holston River, rising in southwestern Virginia. The Tennessee flows southwest across the eastern part of the State of Tennessee into northern Alabama, thence generally westward to the northwest corner of the State, where for a short distance it forms the boundary between Mississippi and Alabama, and thence north across Tennessee and Kentucky to the Ohio at Paducah, at a point about 44 miles from where the latter empties into the Mississippi River. The total length of the Tennessee is 652 miles. It is 184 miles from Knoxville to Chattanooga, 208 miles from Chattanooga to Florence, and 256.5 miles from Florence to Paducah. The total drainage area is 40,570 square miles, and the low-water discharge at the mouth is about the same as that of the Ohio at the junction of the two rivers.

2. Navigation facilities: The navigation facilities will be summarized under various stretches of the river.

(*a*) French Broad and Holston Rivers: These are navigable streams over a large portion of their lengths.

(*b*) Tennessee River from Knoxville to Chattanooga, 184 miles: The river is navigable throughout the year for light draft traffic.

(*c*) Tennessee River from Chattanooga to Hales Bar, 33 miles: Six-foot navigation has been developed between Chattanooga and Hales Bar by means of the Hales Bar power and navigation dam which is now installed. The construction was by private capital, except that the gates, valves, and operating machinery of the lock were provided by the United States at a cost of $236,388. The total cost of the dam and equipment amounted to some $11,000,000. The dam has an installed capacity of 45,000 horsepower.

(*d*) Tennessee River from Hales Bar to Browns Island, 138 miles: The present project calls for two low dams with lifts of some 8 feet, one at Widows Bar and the other at Bellefonte Island. This construction will extend 6-foot navigation from Hales Bar down to Bellefonte Island, 39 miles. The Widows Bar Lock has been started, but preliminary work only has been done at Bellefonte Island.

Three additional locks and dams have been recommended in order to secure 6-foot navigation between Bellefonte Island and the Muscle Shoals section. These have not been authorized and the present project calls for open-channel work only to secure a 5-foot channel.

The actual conditions over this entire distance allow of light-draft navigation only throughout the greater part of the year. It amounts to 3 to 4 foot draft for six months, with lesser drafts during the remainder of the year.

(*e*) Tennessee River, Muscle Shoals section, or Browns Island to Florence, 37 miles: The shoals in this section (Elk River, Big Muscle, and Little Muscle) are caused by hard flinty rock strata which have caused the river to widen out in places to nearly 2 miles. The total fall in the 37 miles is 134 feet. Without improvement over this section upstream navigation was never possible. Downstream navigation was occasionally attempted by rafts and light vessels, but always with great risk.

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In 1875 work was commenced on the present canal, which consists of two sections, one on the north bank, 14½ miles long, with a lift of 85 feet in nine locks, overcoming Big Muscle Shoals, and one on the south bank, 2½ miles long, with a lift of 17 feet in two locks, at the Elk River Shoals. The two sections are 8 miles apart. The work was completed in 1890 at a total cost of $3,191,726.50. The original project called for another section of canal to overcome Little Muscle Shoals, and carry the improvement to Florence, but this was changed to provide for open-channel work.

The canal proper gives 5 feet navigation, but, owing to deficient depth in the river between the two sections and below the lower section to Florence, the minimum available depth throughout the year is less than 2 feet; 3 feet are available about six months and 4 to 5 feet are available for a shorter period.

Navigation is now entirely blocked by the incomplete Wilson Dam.

(*f*) Tennessee River, Florence to mouth, 257 miles: The present project calls for a channel 6 feet deep at ordinary low water, and 5 feet deep at extreme low water, to be secured by open-channel methods, except at Colvert and Bee Tree Shoals. To pass by these shoals a lateral canal 8 miles long with one lock is provided. The canal is completed and the open-channel work about 80 per cent complete. Four-foot navigation is usually available from Florence to the mouth throughout the year, and 6-foot navigation for about 8 months.

3. Cost of development of navigation over Muscle Shoals section: The combination of steep slope, high banks, and the great volume of water in the Muscle Shoals section of the river make it a favorable location for a large power dam or dams. This fact has long been recognized and for many years the dream of a big dam in this region has been taking shape. Numerous examinations and surveys have been made under congressional authorization with a view to securing development of water power in connection with improvement of navigation through joint action of private agencies and the Government. A report favorable to development along these lines was finally made by the Corps of Engineers some six or eight years ago. In view of the national defense act of 1916, however, the proposed contract with private interests for joint project was abandoned.

The consensus of opinion at the present time seems to indicate that navigation and power development in the Muscle Shoals section could best be accomplished by the construction of three dams.

The No. 1 Dam would be located just above the Florence Bridge and would consist of a lock and low dam connecting Pattons Island, in the Tennessee River to the north shore of the Tennessee. Pattons Island, which extends upstream some 2 miles, would be connected with the locks of the No. 2 Dam, so that in reality there would be a canal from the No. 2 Dam to the No. 1 Dam. This No. 1 Dam is for navigation purposes only and would not supply any power. The estimated cost of the No. 1 Dam is $1,400,000.

The No. 2 Dam, now officially designated the Wilson Dam, is located about 3 miles upstream from the site of the proposed No. 1 Dam. This No. 2 Dam would raise the water approximately 95 feet and would give in excess of 6 feet navigation to the proposed site of the No. 3 Dam, a distance of some 15 miles.

The proposed No. 3 Dam would raise the water some 40 feet and would give a minimum of 6 feet navigation a further distance upstream of approximately 65 miles.

These three dams would, therefore, give a minimum of 6 feet navigation over a distance of some 83 miles.

There is considerable doubt as to what cost should be set aside for navigation improvements, in the construction of these dams. The estimated cost of the No. 1 Dam, or $1,400,000, should apparently be charged in toto to navigation. Assuming that the other two dams, or Nos. 2 and 3, are to be built for the development of power only, the cost of providing navigation would be merely the excess cost of putting in locks over that of a solid section of the dam. The approximate cost of this would be $2,860,000 for Dam No. 2 and $1,425,000 for Dam No. 3, or $4,285,000 for both dams.

Assuming that the two dams, or Nos. 2 and 3, are not built for the development of power, the cheapest way in which navigation could be provided over this stretch of river would be by—

(*a*) Dredging the river and constructing low dams or dikes in the river above the upper section of the present Muscle Shoals Canal.

(*b*) The construction of a low dam across the river at Lock No. 1 of the lower section of the present canal to provide sufficient depth in the 8 miles of open water between the two sections.

(*c*) The construction of a lock at the site of Dam No. 2, or the Wilson Dam, with low dams connecting the island across to the south bank to submerge the rapids at Muscle Shoals, and thus provide access to Lock No. 9 (the lowest lock) of the section of the existing canal.

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All of this work would be for the purpose of completing and making effective the present Muscle Shoals Canal, which can not now be used to full advantage on account of deficient depth of the river above the upper section, between the two sections, and below the lower sections thereof. The cost would be approximately $8,600,000, to which should be added the cost of No. 1 Dam, or $1,400,000, making a total of $10,000,000. This construction would provide only for 5-foot depth of channel, and this channel would be narrow and somewhat difficult of navigation. It would, of course, be far less suitable for the development of navigation than that which would be provided by the two high power dams now under consideration.

To provide a 6-foot channel over this stretch of river the present canal would have to be reconstructed and work done in the river above and below and between its two sections similar to that described in the preceding paragraph, but on a more extensive scale. The estimated cost of this work would be approximately $25,786,000, to which should be added the cost of the No. 1 Dam, $1,400,000, making a total of $27,186,000. This estimate is based upon plans contained in a survey report by Major Harts, Corps of Engineers, under date of March 21, 1910, and may be assumed as representing the best and cheapest method of providing for 6-foot navigation over this 80 miles of river if no attention were paid to the development of power.

The value to navigation of the power dams, or Nos. 2 and 3, should be considered, therefore, as being not in excess of $25,786,000 and not less than the additional cost of putting locks in the two dams, or $4,285,000. The more logical minimum factor would seem to be the $8,600,000 which would be required to provide a 5-foot depth of channel.

4. Conclusions as to development of navigation over Muscle Shoals section: The Government has apparently definitely adopted the policy of developing the Tennessee River for navigation as it has been appropriating money year after year for such purpose. The question as to whether some development of navigation is worth while seems, therefore, to have been answered. Considerable progress seems to have been achieved in certain regions, although in others the work done at considerable expense has been wasted. This is apparently because the open channel method employed in some stretches has not been of lasting value. The experience seems to indicate that permanent improvements to navigation can only be achieved by permanent locks, dams, and canals.

The Muscle Shoals section, which is located less than half way up the navigable stretch of the river, is practically the first and the most serious obstacle to navigation. To develop satisfactory and permanent navigation it is necessary, therefore, to erect permanent works to care for the Muscle Shoals section. This can apparently be done with maximum benefit and minimum expense to the country through a combination of navigation and water-power development.

The completion of the No. 2, or Wilson Dam, would eliminate the definite obstacle that now exists due to the partly finished dam, and would provide a minimum of 6-feet navigation over some 15 miles of river. The additional expense required to complete this dam could be justified even though no part of it were charged to navigation.

The No. 3 Dam would extend 6-foot navigation from the head of the pool formed by the No. 2 Dam for an additional distance of some 65 miles. This dam could not pay for itself as a power proposition unless some six to eight million dollars were charged off to navigation.

To install the navigation features of these two dams would cost $4,285,000 ($2,860,000 for Dam No. 2 and $1,425,000 for Dam No. 3). To create 5-foot navigation over the region included by the pools of these dams would cost over $8,600,000. To create 6-foot navigation over the same region would cost some $26,000,000.

It would seem, therefore, that the logical minimum factor to be charged to navigation in these two dams would be $8,600,000.

To connect the No. 2 Dam with the downstream navigation would require a small additional dam (No. 1) for navigational purposes only, the cost of which would be about $1,400,000.

As to whether development of navigation at the present time over the Muscle Shoals region is worth the expenditure of some $10,000,000 is open to very serious doubt.

IV. *Power possibilities of Muscle Shoals.*—The following framework is followed:

1. General statement.

2. Power available (*a*) Dam No. 2, or Wilson Dam; (*b*) Dam No. 3; (*c*) steam plant at nitrate plant No. 2.

3. Possibilities of increasing primary power by storage dams in upper waters of Tennessee or other rivers.

4. Probable power market.

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5. Relationship of Muscle Shoals power to the general supply of power in the regions adjacent to Muscle Shoals.
6. Cost and time required to complete Dam No. 2 and to construct Dam No. 3.
7. Probable value of Muscle Shoals power developments.
8. Conclusions.

1. General statement: The power possibilities of Muscle Shoals are centered in Dam No. 2, or Wilson Dam, Dam No. 3, and the auxiliary steam plant located at United States nitrate plant No. 2. The flow of the Tennessee is very irregular and varies from a minimum flow of some 8–10,000 second-feet to a normal maximum of some 150,000 second-feet and a flood maximum of 440,000 second-feet. If the flood waters could be held back by storage dams or otherwise and the flow at Muscle Shoals made of a more uniform character, the amount of primary power could be correspondingly increased. For this reason storage reservoirs in the upper branches of the Tennessee have a very important bearing upon the power possibilities of Muscle Shoals.

The steam plant at Gorgas on the Warrior River is not included as part of the Muscle Shoals power as it is believed the Government should sell its interests in this plant to the Alabama Power Co.

Nor is the power plant at United States nitrate plant No. 1 included as this has a capacity of only 5,000 kilowatts and is too small to affect the situation appreciably. Furthermore, its power would be quite expensive.

2. Power available at Muscle Shoals—(*a*) Dam No. 2:

Horsepower available.	Per cent of time available.	Months available.	Horsepower available.	Per cent of time available.	Months available.
87,300	99.4	12	306,000	50.0	6
100,000	97.0	[1] 12	600,000	20.0	2½
141,000	83.3	10	1,100,000	7.0	1
205,000	66⅔	8			

[1] Practically.

(*b*) Dam No. 3: Dam No. 3 can produce approximately 40 per cent as much power as Dam No. 2.

Power available in terms of kilowatt hours: In terms of kilowatt hours, Colonel Barden submitted the following table as the probable output of Dams Nos. 2 and 3:

Probable power output, Muscle Shoals, Ala., based on 49-year stream-flow record.

Class of power.	Horsepower.	Kilowatts.	Kilowatt-hours per year.		
			100 per cent.	80 per cent.	60 per cent.
Wilson Dam:					
Primary	87,300	65,100	570,269,800	456,215,800	341,161,900
10 to 12 months	53,700	40,044	325,092,600	260,074,100	195,055,600
8 units [1]	100,000	74,570	420,600,400	336,480,300	252,360,200
6 to 10 months	165,500	123,413	654,375,000	523,500,000	392,625,000
4 to 6 months	131,500	98,060	353,362,800	282,690,200	212,017,700
Total	438,000	326,617	1,903,100,200	1,522,480,100	1,141,860,200
Dam No. 3:					
Primary	34,000	25,385	222,372,000	177,897,900	133,423,400
10 to 12 months	21,500	16,001	129,891,000	103,913,100	77,934,800
6 to 10 months	67,000	49,962	280,969,000	224,774,900	168,581,300
4 to 6 months	57,000	42,505	153,615,000	122,891,900	92,168,900
Total	179,500	133,853	786,847,000	629,477,700	472,108,300
Total:					
Primary	121,300	90,485	792,641,800	634,113,600	475,585,300
10 to 12 months	75,200	56,045	454,983,600	363,987,200	272,990,400
6 to 10 months	232,500	173,375	935,344,000	748,274,900	561,206,200
4 to 6 months	188,500	140,565	506,977,800	405,512,100	304,186,600
Total	617,500	460,470	2,689,947,200	2,151,957,800	1,613,968,500

[1] Limit.

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(c) Steam plant at nitrate plant No. 2: This plant has an installed generating capacity of 60,000 kilowatts or 80,000-horsepower. It has sufficient steam capacity for about 75,000 kilowatts, or 100,000-horsepower. The power house has a place provided for an additional 30,000-kilowatt generator, and water arrangements are sufficient for a total installation of 90,000 kilowatts or 120,000-horsepower. Some additional boilers and housing therefor would have to be provided for the 120,000-horsepower installation.

The CHAIRMAN. There is a possibility of 120,000-horsepower from that steam plant?

Major BURNS. Yes, sir, in accordance with the present lay-out.

The CHAIRMAN. By the installation of additional equipment?

Major BURNS. By the installation of a few additional boilers and of a generating unit. The reason for this condition is that when they started the plant they expected to construct a 90,000-kilowatt plant, and they provided a water intake on that basis, and built the power house on that basis. It was there decided that only a 60,000-kilowatt plant was needed and it was completed in accordance with this latter capacity. So that it is really more than a 60,000-kilowatt plant.

The CHAIRMAN. It has a capacity, without any additional boilers, of 80,000-horsepower?

Major BURNS. Yes, sir.

3. Possibilities of increasing primary power by storage dams in upper waters of Tennessee or other rivers: Two schemes have been suggested for increasing either actual or, in effect, the primary power at Muscle Shoals. One is the construction of storage reservoirs or other means of holding back flood waters in the upper branches of the Tennessee, and the other is to create storage reservoirs on other rivers, as, for instance, the Tallapoosa, the water of which would be turned into power to supplement the secondary power at Muscle Shoals. This latter scheme requires, of course, the tie-in of Muscle Shoals power with a system using Tallapoosa power.

In the matter of storage reservoirs on the Tennessee, the district engineer at Chattanooga has just completed a preliminary survey of the possibilities thereof and it is understood that recommendation is to be made to Congress for the necessary appropriations to make the detailed survey necessary to determine just what the expectations are. The testimony before the committee is to the effect that in the Tennessee and its tributaries some 46 combined reservoir and power dams are believed to be feasible, each having a draw-down capacity varying from 5,000 to 800,000 acre-feet. The two largest with capacities of 700,000 and 800,000 acre-feet, respectively, are located on the Clinch River. The district engineer thinks that if their draw down were properly regulated in the interest of the Muscle Shoals dams the minimum flow and therefore the primary power could be about doubled in an average year.

4. Probable power market: The Alabama Power Co. has testified before the Military Affairs Committee of the House and the Senate Agricultural Committee, in effect, that it might be possible to develop a maximum load for their system by the year 1926 of some 880,000 horsepower. Their present maximum capacity is 190,000 horsepower and they have under construction the Mitchell Dam with a rated capacity of 110,000 horsepower. They also have under temporary lease the Muscle Shoals steam plant with capacity of 80,000 horsepower. On this basis their total maximum capacity is 380,000 horsepower. This would leave a deficit of some 500,000 horsepower which might be supplied by Muscle Shoals hydroelectric power. The summary of the Alabama Power Co. in this connection follows:

General statement concerning power situation in Alabama and contiguous territory.

	Horsepower.
The present power and lighting load of Alabama Power Co. can be considered as	135,000
The maximum load established in December, 1921, due to urgent needs for power in Georgia and Carolina, was	160,000
With a return to normal business conditions in coal, iron, and textile industries in 1922, the power and lighting load, exclusive of requirements in Georgia and Carolina, will be	160,000
Assuming 10 per cent per annum as a measure of natural growth of load due to increased use by present customers, plus new industries that will be attracted into the State by low-priced power, the load in 1926 will be	210,000
There is an available power load in territory adjacent to present transmission lines of Alabama Power Co., exclusive of railway electrification, of	160,000
There is a power load available to Alabama Power Co. by extension of lines to Memphis, New Orleans, Mobile, Meridian, etc., of	200,000

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	Horsepower.
The Tennessee Power Co., the Georgia Railway & Power Co., the Columbus Power Co., the Central Georgia Power Co., in order to supplement existing plants, will absorb	570,000
Railway electrification in Alabama alone offers a potential market for	240,000
The total load in 1926, inclusive of present load plus prospective load, may reasonably be	880,000
Alabama Power Co. present generating capacity	190,000
Additional generating capacity from Muscle Shoals steam plant	80,000
Additional generating capacity from Mitchell Dam	110,000
Total generating capacity available under present program without Muscle Shoals in 1926 will be	380,000
Deficit to be supplied by Muscle Shoals	500,000

The representatives of the Georgia Railway & Power Co., the Columbus Power Co., the Central Georgia Power Co., and the Tennessee Power Co., in their letter to the Chief of Engineers of May 20, 1921, stated in substance that in their estimation the demand for power in the southeastern territory would absorb an additional capacity of some 500,000,000 kilowatt hours by 1927. This quantity is approximately the primary power of the Wilson Dam. In other words, they think that the primary power of Wilson Dam can be absorbed by 1927.

Senator McKINLEY. That is 100,000 horsepower?

Major BURNS. Yes, sir; approximately. In Colonel Kellar's report to the Secretary of War in 1921, The Power Situation During the War, it was stated that 1,000,000,000 kilowatt hours would be needed in the southern territory in from five to seven years. This would be about twice the primary power of Dam No. 2.

These estimates, together with the definite offer of the Alabama Power Co. to complete the Wilson Dam, seem to conclusively establish that a market could be found through the natural expansion in power requirement in the territory adjacent to Muscle Shoals for the primary power to be developed at the Wilson Dam upon its completion. Nor does it seem unreasonable to conclude that a ready market could be formed for the additional primary power that would be made available from the No. 3 Dam if finished within two or three years after the No. 2 Dam. In the matter of secondary power it is more difficult to come to a conclusion but it seems fair to assume that all of it of reasonable value could be marketed within some five years after the completion of each dam. And of course if special industries were established at or near Muscle Shoals to absorb the power therefrom the question of a market for power would be solved thereby.

The CHAIRMAN. It is natural to suppose, Major, that if it were known now that Dams Nos. 2 and 3 were going to be constructed within the time estimated, by the Army engineers, that of itself would have a tendency to cause people who wanted power to investigate the subject and perhaps locate in the vicinity?

Major BURNS. Yes, sir. And of course that is a very important point in the handling of this power problem. The policy with reference to the distribution of power will have to be known two or three years before the power becomes available, so that the market can be created.

The CHAIRMAN. Yes.

Major BURNS. Otherwise you may have the dams there with power available and no market.

The CHAIRMAN. If we had it all there now we could not sell it.

Major BURNS. No, sir.

The CHAIRMAN. If we knew to-morrow that we were going ahead to construct these two dams, or somebody was, it would have a tendency to cause various kinds of industry to look into the subject with a view to building and getting ready to use the power by the time it was ready to deliver.

Major BURNS. Yes, sir. I think that is an important point to keep in mind.

The CHAIRMAN. There are some industries that would realize that we would have there a great deal of secondary power that would be sold very cheap.

Major BURNS. Yes, sir.

The CHAIRMAN. Men who are in business that could use secondary power would very naturally commence to investiagte if they knew that within two or three years there was going to be that supply, I should think.

Major BURNS. Yes, sir. You are correct.

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5. Relationship of Muscle Shoals power to the general supply of power in the region adjacent to Muscle Shoals: The Alabama Power Co. has stated before the Military Affairs Committee of the House: "It (Muscle Shoals) is, of course, the largest water power in the South, and without it the developments which exist in this immediate territory are not sufficient to supply these markets in the States of Mississippi and Louisiana, and even as far away as Memphis. * * * When we reach the end of the Appalachian Chain in the State of Alabama there is no water power after you pass Alabama until you get beyond the Mississippi River, hundreds of miles away. That whole development of water power in Alabama, then, is the last, and the last opportunity the public will have south and southwest to obtain hydropower. If withdrawn from the public service, there is no opportunity for them ever to obtain hydropower". It pointed out that within a radius of 150 miles are located Memphis and Jackson, Tenn., which have no hydropower; Nashville and Columbia, Tenn., which could have additional hydropower; and also Meridian, Miss. Within 200 miles are Little Rock and Vicksburg which have no hydropower. Within 300 miles are Natchez and Mobile which have no hydropower. Within 350 miles are New Orleans, Baton Rouge, and Pensacola, and within 400 miles the City of Shreveport, none of which have hydropower. The Chief of Engineers stated before the Military Affairs Committee of the House that the Alabama Power Co. is "sending power at a voltage of about 110,000 volts to a distance of 250 miles." He also states: "There have been claims made by people engaged in electrical transmission of power that they are perfecting that work so that they can transmit power as economically, or will be able soon to transmit power, to a distance of 400 miles as economically as they do at present to a distance of 200 miles". He also stated that, by a system of relaying power, it is now being made available at a distance of 600 miles.

I mention that to show that all of these places that are mentioned are within transmission distance of Muscle Shoals.

The CHAIRMAN. You are quoting somebody else. What is your idea about that, Major?

Major BURNS. I think that is correct.

The CHAIRMAN. You agree with that?

Major BURNS. Yes, sir; absolutely.

Senator MCKINLEY. Major, are they not delivering power 275 miles in California now?

Major BURNS. I think they go a little further than that. I have seen it stated that they are delivering it at 400 miles in California.

The CHAIRMAN. They are constantly improving methods of transmission of electric energy.

Major BURNS. Yes, sir. They are increasing the voltage and reducing the wastage of current and cost of transmitting. And then they have the relay system which has just come into use which is exceedingly important because due to one company helping another out, they are able in effect to make delivery of power much further than by direct transmission.

The CHAIRMAN. I will ask you now in your judgment if the development of power at Muscle Shoals could be economically carried to New Orleans, Little Rock, Ark., and the other places you have mentioned.

Major BURNS. Yes, sir.

Other witnesses before the Senate committee have contended that it would not be to the greatest benefit of the greatest number if Muscle Shoals were utilized only in furnishing power to such industries as would be developed in the immediate vicinity of Muscle Shoals. Conversely they have contended that the maximum benefit to the greatest number would be obtained if Muscle Shoals power were made available for interconnection with the other power systems surrounding Muscle Shoals. Colonel Keller of the Corps of Engineers in his report to the Secretary of War in 1921, entitled "The Power Situation During the War," in which he reviewed the power situation, stated as follows in respect to Muscle Shoals:

"150. It appears, therefore, that a broad and well-founded judgment would dictate that the Muscle Shoals development should be interconnected for exchange of power with the existing power systems of the Southern States and that this interconnection and exchange should be arranged for without delay so that future construction both at Muscle Shoals and elsewhere can be directed for the production of plants which will supplement each other for economy of construction and operation."

In this connection it should be noted that the various rivers in Tennessee, the Carolinas, Georgia, and Alabama, which are now furnishing hydroelectric power do not have their minimum flow at the same time. As a consequence, if interconnected, (and they are interconnected at present) they can be used to supplement each other to a certain extent.

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On the other hand it has been contended by other witnesses that the products of power are distributed over a greater area than is power itself, and that, therefore, a concentration of industry at Muscle Shoals would not be second in benefit to the general community to a general distribution of the power from Muscle Shoals.

This latter argument might have weight if the manufacturers were forced to limit profits in their products in accordance with the cost of power in the same way that public utility corporations are required, through public service commission control, to limit their profits on power.

The CHAIRMAN. Right in that connection, those who contend that all of the power ought to be used right at Muscle Shoals, like Mr. Ford proposes to use it, for instance, and thereby cheap manufactured products be made there, and they be shipped instead of the power transmitted, lose sight of the fact, do they not, that under Mr. Ford's offer, or anyone else's who is going to concentrate it all there and have it absolutely without regulation, would not have their products regulated as to price by any commission or any governmental authority, and they could ship it anywhere they please and sell it at any price they please, whereas if the energy is transmitted it is always under the supervision either of the State or the Federal Government that regulates the rates that they can charge to the consumer.

Major BURNS. Yes, sir. I think that point has been overlooked in their argument.

The CHAIRMAN. And the man who manufactures a completed product at Muscle Shoals, or anywhere else, and gets the benefit of cheap power, when he comes in competition with somebody else in some other locality, who manufactures by power that is not as cheap, all he does—and I say it without criticism; I would do the same myself if I had it—is to sell his completed product at a price that will find a market. He undersells the fellow who has no such cheap power only enough to make the sale and pockets the balance.

Major BURNS. That is correct. He governs his business by the ordinary rule of supply and demand.

The CHAIRMAN. Yes, certainly. He sells it for all he can get for it. Therefore, the result is if the Government in any substantial way assists a man to develop this power or gives it to him without regulation, it gives to some manufacturer an advantage over his competitors in the commercial world.

Major BURNS. Yes, sir.

This question as to how to best protect the interest of the greatest number of people in the matter of utilizing the power at Muscle Shoals is unquestionably the most important one in connection with the whole Muscle Shoals project. Four general schemes have been expressed before the Senate Committee as to the best method of utilizing the Muscle Shoals power:

First. Lease or sale of Muscle Shoals power project for 100 years with no control by Government over method of using such power or the rates at which it shall be used unless it should happen to come under State or Federal regulation of public utilities, with the exception, however, that an unknown and not stipulated quantity of power shall be used in the manufacture of fertilizer.

Second. Complete retention of control by Government through governmental construction and opeation.

Third. Administration of Muscle Shoals power project in conformity with the national policy on water power development as outlined in the Federal water power bill. In this instance the power project would be completed by private capital under license from Federal Power Commission and such license would guarantee governmental control of the project and allow Government to recapture at end of fifty years.

Fourth. Partnership between the Government and private capital by which each supplies a part of the capital and shares in profits or losses. Operation is by private capital methods under control by directors appointed by each party. In addition the general control system of the Government would apply.

6. Cost and time required to complete Dam No. 2 and to construct Dam No. 3: Various estimates have been submitted as to the probable costs of completing these dams. In the memorandum by the Chief of Engineers accompanying the Secretary of War's letter to Congress forwarding the Ford offer it is stated, as follows:

"The Engineer Department's estimate made in July, 1921, for completing Dam No. 2 with its full power equipment is in round numbers $28,000,000, and in August, 1921, for constructing Dam No. 3, $28,000,000.

"The estimate of Mr. Ford's engineers for completing Dam No. 2 is in round numbers $23,230,000; for Dam No. 3, $19,000,000.

"Construction of Dam No. 2 has so far advanced that foundation conditions are thoroughly established, and the work required can be predicted with certainty, leaving as the only uncertainty the cost of executing the work. The condition does

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not exist at Dam No. 3, where the foundation work necessary will not be certainly determined until the bed of the river is laid bare. The Engineer Department's estimates are regarded as adequate to meet any reasonable eventuality of construction at the costs current when the estimates were prepared.

"Subsequent to the preparation of the Engineer Department's estimates the prices of material and labor have generally declined, and it is believed that a reduction of about 10 per cent in the prior estimates is now justifiable. The cost of completing the two dams with power equipment for purposes of this analysis is therefore taken at $25,000,000 each, in round numbers, or $50,000,000 in all.

"The time of completion of Dam No. 2 has been placed at 40 months, of No. 3 at 36 months. Considering, however, the fact that the hydroelectric machinery for the first 100,000 horsepower of No. 2 is already under contract, and that the first units can be put in operation prior to the eventual completion of the entire installation, it is considered that, for purposes of analysis, the time before payments begin to accrue may be placed at three years for each dam."

The above figures and in fact no figures used except where specifically indicated include costs of flowage rights for Dam No. 3 which are estimated to total $2,331,000.

Colonel Barden's estimates for completing the work of providing draft tubes, excavation, and power-house substructure for the total number of units contemplated but actually installing at the present time only four units, amounts in the case of Dam No. 2 to $20,849,000. If eight units were installed the corresponding cost would be $23,177,000. And if the entire eighteen units were installed the cost would be $28,500,000. The Alabama Power Co. estimates that it could complete the dam and install eight units for $18,854,000 (that is, four and a half million dollars less than Colonel Barden estimates) and that they could install 18 units for $26,354,000 (that is, about $2,000,000 less than Colonel Barden estimates).

Colonel Barden estimates that it will cost $25,000,000 to complete Dam No. 3. No. 3 dam is a lower dam than No. 2, having a lift of about 40 feet as compared with a lift of 97 feet in No. 2, No. 3 would be some 6,700 feet long as compared to 4,500 feet for No. 2.

Colonel Barden estimates it will take some three years to complete Dam No. 2, and emphasizes the necessity of three low-water periods. He also estimates it would take some three years to construct Dam No. 3, and states that the most economical construction of Dam No. 3 would depend upon the use of the same construction plant that is now used for the construction of No. 2. In other words, under such arrangement No. 3 Dam would not be completed for six years.

Some question has been raised as to the probability of leaks through seams in the river bed or on sides of river. Both the Corps of Engineers and Col. H. L. Cooper believe no serious trouble need be feared so far as No. 2 Dam is concerned.

The Corps of Engineers has made some borings at the site of Dam No. 3, but states in effect that it has not made sufficient investigation to determine a definite plan for the foundations nor the troubles that might be encountered through cavitation, seams, etc.

The CHAIRMAN. Let me ask you there, how much money has the Government spent on Dam No. 3, in making borings?

Major BURNS. I don't know that. I will have to look that up.

The CHAIRMAN. Have you any idea as to the amount?

Major BURNS. I think it is rather small. I would guess that they did not spend in excess of $50,000.

The CHAIRMAN. I was under the impression they had completed the borings clear across the river.

Major BURNS. They apparently are not satisfied with their borings, because I am quoting here from the letter of the Chief of Engineers, which was written two or three months ago, and he says definitely that he has not made sufficient investigation to find out what kind of foundation there is.

The CHAIRMAN. I was under the impression that they had completed them and were satisfied with the foundation. What was your idea, Senator McKinley? You were there.

Senator MCKINLEY. I did not think they were satisfied.

The CHAIRMAN. I must be wrong. I was under the impression that they spent a lot more than you had estimated, Major.

Major BURNS. That was really a guess, Senator. I would have to look that up.

In this connection it is pointed out, however, that Colonel Cooper (who is employed by the Corps of Engineers as the designing engineer of the No. 2 Dam) recommended to the Senate Agricultural Committee in substance that a special committee of experienced engineers be appointed to check up designs, methods, conditions, etc., to insure that everything connected with Dam No. 2 was satisfactory.

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The CHAIRMAN. I have always been under the impression that that recommendation, as I remember very distinctly that Colonel Cooper made, was made on account of perhaps an oversensitiveness on his part that somebody else ought to go over his work, not because he had any doubt about the possibility of finding anything wrong there. He seems to be well satisfied, and so do the Government engineers, as far as I am able to determine, that there is nothing wrong.

Major BURNS. That is the impression I got from both Colonel Barden's and Colonel Cooper's testimony—that they are satisfied.

The CHAIRMAN. So Colonel Cooper's wish that the Government spend a lot more money and hire a lot more of experts to go down there and examine it did not impress me very much, because it seemed to me it would cost a great deal of money to do it, to get high class people, and if there was a dispute in the end we would have to follow one doctor or the other, and I got on the idea if you hire a doctor you ought to be prepared to follow his advice, the same as you would a lawyer.

Major BURNS. I brought that out to show that there might be some doubt. However I did not get the idea that there was any doubt, but Colonel Cooper impressed me that he was willing for any kind of investigation to be made or any kind of a commission to look into it and see whether he is right or wrong.

7. Probable value of Muscle Shoals power developments—(*a*) General statement: It is very difficult to determine the value of the power developments. Assumptions as to the future must be made in order to give a basis on which to make calculations and there are so many variables in connection with Muscle Shoals that the making of reasonable assumptions is not any easy matter. In the effort to make reasonable assumptions discussions have been had with various power engineers who understand Muscle Shoals and the assumptions which follow are believed to be reasonably conservative.

(*b*) Assumptions: In making an analysis of the value of the Muscle Shoals power project, the following assumptions have been made:

(1) That the ultimate development at Dam No. 2 will be for 540,000 horsepower which has been divided, according to the period of the year during which the power will be available, into classes as follows:

Horsepower available 99.4 per cent of the time	87,300
Horsepower available from 9 to 12 months	72,700
Horsepower available from 7 to 9 months	80,000
Horsepower available from 5 to 7 months	120,000
Horsepower available from 4 to 5 months	90,000
Horsepower available from 3 to 4 months	90,000
Total	540,000

(2) That the installation at Dam No. 2 will consist of eighteen 30,000-horsepower units, four to be installed on completion of the dam; four, one year later; four, two years later; three, three years later; and three, four years later, and that the market will develop in such a way that these units can be loaded as soon as they are ready for service.

(3) That Dam No. 3——

The CHAIRMAN. Before you take up Dam No. 3, the installation of that power is only an estimate and could be varied, of course, according to conditions?

Major BURNS. Yes, sir. That is what you would do in actual practice.

The CHAIRMAN. Yes. If you found you had a demand for power, you would put all these things in at once?

Major BURNS. Yes, sir. It would depend upon the market.

The CHAIRMAN. Exactly. If you need them you put them in, and if you don't, you wait for the market.

Major BURNS. We made these assumptions in order to show what, in our judgment, that power is worth down there.

(3) That Dam No. 3 will be equipped for 216,000 horsepower, which is 40 per cent of that at Dam No. 2; and that the market will develop in such a way as to call for the installation of one-third of the equipment when the dam is completed, one-third one year after the dam is completed, and one-third two years after completion of the dam.

(4) That the No. 2 steam electric plant will be used to its full capacity for the purpose of supplementing a part of the secondary power at Dam No. 2.

The CHAIRMAN. Have you taken the steam plant at plant No. 1 into consideration?

Major BURNS. No, sir.

The CHAIRMAN. Why haven't you done that?

Major BURNS. Because it is a small steam plant with only 5,000-kilowatt capacity.

The CHAIRMAN. How many horsepower?

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Major BURNS. That would be 6,600 horsepower.

Senator MCKINLEY. That is a direct-current plant, and you would have to transform it if you carried it any place.

Major BURNS. The cost of generating power from that small plant would be too high to tie into a big system.

The CHAIRMAN. I should think it could be economically used at times when there was just a little deficiency, rather than start up your big plant.

Major BURNS. Of course to do that you would have to have your stand-by crew there all the time.

The CHAIRMAN. You would have a crew at No. 2 anyway. They are close together.

Major BURNS. They are about 5 miles apart.

The CHAIRMAN. Yes.

Major BURNS. You might be able to do that, but it would have no appreciable effect upon the figures.

(5) That energy from Dam No. 2 and No. 3 can be sold at the dam on the following basis:

Primary	per K. W. H..	$0.004
Secondary:		
8½ to 12 months	do	.002
5 to 7 months	do	.0015
3 to 5 months	do	.001

(6) That the load factor would be 80 per cent for Dam No. 2 during the first year and that the load factor at Dam No. 2 after the first year would be 80 per cent for the primary power and for the 9 to 12 months secondary power; that all other power from Dam No. 2 including that supplemented by the steam plant would be used at 60 per cent load factor; that the primary power and the 8½ to 12 months secondary power at Dam No. 3 will be used at 80 per cent load factor and all other power at Dam No. 3 at 60 per cent load factor.

The CHAIRMAN. Major, in making these computations you have estimated, I suppose the cost of coal in operating the steam subsidiary plants there, steam plant No. 2, at the price that it would cost now delivered on the railroad?

Major BURNS. That is correct, yes.

The CHAIRMAN. Have you ever taken into consideration the possibility or probability that when navigation was made possible by means of these dams it would be possible to transport that coal there by water and reduce the cost of the steam plant a great deal?

Major BURNS. I did not do that in these calculations, but that certainly is possible.

The CHAIRMAN. Well, is not that probable?

Major BURNS. Yes, sir; it is not only possible, but probable, and it would have the effect of reducing our coal item probably as much as at least one-fourth.

The CHAIRMAN. And then there is a further possibility I guess, a probability, that mines on the Tennessee River might be opened so that the coal could be loaded from the mines right into a barge on the Tennessee River.

Major BURNS. I thought that was what you had in mind. I understand that there are some good large coal mines in the upper branches of the Tennessee that could be reached if navigation were thoroughly developed over the Tennessee, so that coal could be barged down from the mines directly at No. 2 plant.

Senator MCKINLEY. Is No. 2 on the river?

Major BURNS. Yes, sir.

Senator MCKINLEY. Right on the river, is it?

Major BURNS. It is right on the river.

The CHAIRMAN. Yes. The river flows right by it there; don't you remember, Senator?

Senator MCKINLEY. No; I didn't remember that.

(7) That the value of the project to navigation will be $8,600,000 which is the estimated cost of providing 5-foot navigation over that part of the river affected by the two dams. That of this amount $2,860,000 which is the estimated cost of the navigation features of Dam No. 2 should be credited to Dam No. 2 and the remainder, or $5,740,000 to Dam No. 3.

(8) The rate of depreciation on the equipment and structure has been taken at 3½ per cent and one-half per cent, respectively. These figures represent the consensus of opinion on the subject and are believed to be reasonable. The figure of one-half per cent for the dam structure may seem high but due consideration has been taken of the fact that the spillway gates, which are subject to considerable depreciation, are included as part of the dam structure.

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In that connection, I would like to read a letter that we got from the Reclamation Service in our efforts to ascertain what the depreciation on dams is.

WASHINGTON, *June 14, 1922.*

Maj. J. H. BURNS,
3747 Munitions Building, Washington, D. C.

MY DEAR MAJOR BURNS: Answering oral inquiries respecting the depreciation or maintenance cost on masonry dams, our experience has been that such cost is very low, probably so low that insufficient time has elapsed to permit any general conclusions from the structures of the Reclamation Service. Also the conditions affecting the different structures vary so that it is dangerous to draw conclusions as a guide for prediction elsewhere.

However, I am sending you herewith a copy of the latest (twentieth) annual report, in which will be found some information along this line. For example, in the case of the East Park Dam there was charged to maintenance account $186 for the calendar year 1920 (p. 105). This structure, with related spillway and dikes, cost about $154,000; the whole storage unit, involving in addition to the dam a feed canal and other items, cost somewhat over $450,000 (p. 104). The dam is a concrete arch, gravity type, with a maximum height of 139 feet, crest length of 250 feet, and volume of 12,200 cubic yards (p. 538). It was completed in July, 1910 (p. 100). From that time to December 31, 1920, the maintenance account for the dam was charged with a total of $8,015 (p. 105).

Similar data respecting other dams of the Reclamation Service can be found in the same way throughout the report. In some cases the data are not given separately for the dam, but show only the totals for the reservoir, and in a few cases there may be shown only the total figures for the project storage system, which may include more than one reservoir.

From these figures and from actual knowledge, I know that the maintenance costs on the dams themselves have been exceedingly low. Probably the bulk of the costs given in the report after the fashion above indicated do not represent any work on the main structures, but include repairs and replacement of operating mechanisms and such things which are related to the dams and which are much more subject to depreciation.

In a few cases there have been substantial expenditures connected with the dams of the Reclamation Service some time after their construction, and it may be that these are charged to the maintenance account, because they are technically classified that way in the eyes of the law governing us, and the charges we collect from the irrigators who benefit from the works. However, in these cases that I have in mind the substantial repairs or other work were due either to the repairing of damage by flood or to the completion of some work that was deliberately postponed when the dams themselves were first built. In the first category there were some substantial repairs to the spillway at the Roosevelt Dam on the Salt River, Ariz. In recent years a flood came with the reservoir full and put a considerable depth of water over the spillway. This eroded the spillway channels to an extent that made it seem wise to concrete them in anticipation of future floods. This might be called repair, but is more accurately described as betterment, being simply additional work over that originally contemplated and carried out, rather than repair or replacement of something that had been built and worn out.

In the other category falls another case of spillway improvement at the Elephant Butte Dam. Here it was always contemplated that substantial work would be required on the spillway additional to what was done when the dam was built, but the work was postponed to spare the expenditure until necessary as well as to permit the selection of a time for it that would be more advantageous and economical. It was clear that the work was not needed at first, because the reservoir was designed for large hold-over capacity and took a number of years to fill.

From such figures as I have I think the depreciation or maintenance on the body of a well-constructed masonry dam will usually be a small fraction of 1 per cent of its cost annually.

Very truly yours,

A. P. DAVIS, *Director.*

The CHAIRMAN. I realize that you can not get anything but estimates on that. There has not been any dam like this ever constructed in the world, that is comparable in size, has there?

Senator MCKINLEY. Aswan Dam is just the same.

Major BURNS. I talked this matter over with the Alabama Power Co. They have their Coosa River dam that is subjected to practically the same kind of treatment the

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Tennessee River dam would be. In other words, it has flood waters the same as the Tennessee. They thought that one-half of 1 per cent is quite a liberal allowance.

The CHAIRMAN. How long has that dam been constructed? It was only a few years ago that it was constructed?

Major BURNS. It must be nearly 10 years.

The CHAIRMAN. Don't you think, Major, that where you are considering a hundred-year period we ought to take into consideration the elements that we would not necessarily take into consideration when we were considering a shorter term? In other words, if an insurance company were going to write a policy on insurance, they would not be willing, no man would be, to guarantee the money to keep the dam in repair for a 100 years based on a percentage that they would be willing to take the risk on a 10-year basis, would they?

Major BURNS. No, sir; I don't think so. Apparently, however, the Alabama Power Co. does not feel that we would be justified in charging much more than that. They apparently charge a little less than one-half of 1 per cent.

Senator MCKINLEY. This dam really shows something about $30,000,000 for Dam No. 2, does it not?

Major BURNS. The cost of the structure, excluding the power house and machinery, and excluding also the amount charged to locks, is $32,816,400. Of course, that includes the $17,000,000 that have already been spent.

Senator MCKINLEY. Certainly.

Major BURNS. On that basis.

Senator MCKINLEY. That is, one-half per cent of $32,000,000, or $160,000 a year.

Major BURNS. $164,082 a year, to be accurate on the basis of figuring outlined.

The CHAIRMAN. All right.

(9) That the cost of completing Dam No. 2 with four units will be $37,800,000. Of this total amount the amount invested in equipment at any time will be $1,000,000 plus $550,000 for each unit installed. The amount invested in the dam structure and chargeable to power will be:

Amount invested	$37,800,000
Equipment chargeable to power	3,200,000
	34,600,000
Chargeable to navigation	2,860,000
	31,740,000
Interest on capital during construction for structure chargeable to power	1,076,400
	32,816,400

From this it follows that the new capital chargeable to power will be with four units installed:

Structure	$32,816,400
Equipment	3,200,000
	36,016,400
Already invested	17,000,000
New investment chargeable to power	19,016,400

(10) That Dam No. 3 will cost $25,000,000, of which $5,740,000 is chargeable to navigation, leaving $19,260,000 chargeable to power, to which $1,155,600 should be added for interest on capital during the construction period, making a total of $20,415,600. Of this $7,630,000 will be the cost of equipment, which expenditure will occur as follows:

First year	$3,210,000
Second year	2,210,000
Third year	2,210,000
Total	7,630,000

This leaves $12,785,600 chargeable to the structure against the power development. An additional item of $2,331,000, the estimated cost of flowage rights, should be considered if interest charges are figured.

(11) That no charges are made for interest, taxes, or insurance. These will be in a following paragraph.

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(c) Detailed calculations in accordance with assumptions:

Combination of Dam No. 2, first year (120,000 horsepower installed), and No. 2 steam plant.

SALE OF POWER.

Source.	Horsepower.	Kilowatts.	Load factor.	Kilowatt hours per year.	Rate.	From sale of power.
			Per cent.			
Primary, Dam No. 2	87,300	65,500	80	456,270,000	$0.004	$1,825,080
11 to 12 months, Dam No. 2	32,700					
1 month, No. 2 steam plant	32,700	24,500	80	171,696,000	.004	686,784
Total				627,966,000		2,511,864

PRODUCTION COSTS, DAM NO. 2, WITH FOUR UNITS.

Operation of lock and gates	$35,000
Plant operation expense, at $1 per installed horsepower	120,000
Depreciation on equipment, $3,200,000, at 3½ per cent	112,000
Depreciation on structure, $32,816,400, at one-half per cent	164,082
Total	431,082

PRODUCTION COSTS NO. 2 STEAM PLANT FOR ONE MONTH.

Labor, at $15,000 per month	$15,000
Labor, for 11 months idle	33,000
Coal, at $85,000	85,000
Miscellaneous, at $12,000	12,000
Depreciation on $6,000,000, at 3½ per cent	210,000
Total	355,000

TOTAL COSTS.

Dam No. 2	$431,082
No. 2 steam plant	355,000
Total	786,082

BALANCE.

Income	$2,511,864
Cost	786,082
Balance	1,725,782

NOTE.—No charges made for interest, taxes, or insurance.

Combination of Dam No. 2, second year (240,000 horsepower installed), and No. 2 steam plant.

SALE OF POWER.

Source.	Horsepower.	Kilowatts.	Load factor.	Kilowatt hours per year.	Rate.	From sale of power.
			Per cent.			
Primary, 99.4 per cent, Dam No. 2	87,300	65,500	80	456,270,000	$0.004	$1,825,080
7 to 9 months, Dam No. 2	80,000	60,000	60	315,360,000	.004	1,261,440
3 to 5 months, No. 2 steam plant	80,000					
Secondary, 9 to 12 months, Dam No. 2	72,700	54,500	80	313,330,000	.002	626,660
Total				1,084,960,000		3,713,180

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PRODUCTION COSTS DAM NO. 2 WITH EIGHT UNITS.

Operation of locks and gates	$35,000
Plant operation expense, at $1 per installed horsepower	240,000
Depreciation on equipment, $5,400,000, at 3½ per cent	189,000
Depreciation on structure, $32,816,400, at ½ per cent	164,082
Total	628,082

PRODUCTION COSTS NO. 2 STEAM PLANT FOR 5 MONTHS.

Labor, at $15,000 per month	$75,000
Labor, for 7 months idle	21,000
Coal, at $90,000 per month	450,000
Miscellaneous, at $12,000 per month	60,000
Depreciation on $6,000,000, at 3½ per cent	210,000
Total	816,000

TOTAL COSTS.

Dam No. 2	$628,082
No. 2 steam plant	816,000
Total	1,444,082

BALANCE.

Income	$3,713,180
Cost	1,444,082
Balance	2,269,098

NOTE.—No charges made for interest, taxes, or insurance.

Combination of Dam No. 2, third year (360,000 horsepower installed) and No. 2 steam plant.

SALE OF POWER.

Source.	Horsepower.	Kilowatts.	Load factor.	Kilowatt hours per year.	Rate.	From sale of power.
			Per cent.			
From second year						$3,713,180
Secondary, 5 to 7 months, Dam No. 2	120,000	90,000	60	230,000,000	$0.0015	345,000
Total				1,314,960,000		4,058,180

PRODUCTION COSTS, DAM NO. 2, WITH 12 UNITS.

Operation of locks and gates	$35,000
Plant operation expense, at $1 per installed horsepower	360,000
Depreciation on equipment, $7,600,000, at 3½ per cent	266,000
Depreciation on structure, $32,816,400, at ½ per cent	164,082
	825,082

TOTAL COSTS.

Dam No. 2	$825,062
No. 2 steam plant	816,000
Total	1,641,082

BALANCE.

Income	$4,058,180
Cost	1,641,082
Balance	2,417,098

NOTE.—No charges made for interest, taxes, or insurance.

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Combination of Dam No. 2, fourth year (450,000 horsepower installed), and No. 2 steam plant.

SALE OF POWER.

Source.	Horsepower.	Kilowatts.	Load factor.	Kilowatt hours per year.	Rate.	From sale of power.
			Per cent.			
From third year						$4,058,180
Secondary, 4 to 5 months, Dam No. 2	90,000	67,500	60	120,000,000	$0.001	120,000
Total				1,434,960,000		4,178,180

PRODUCTION COSTS, DAM NO. 2, WITH 15 UNITS.

Operation of locks and gates	$35,000
Plant operation expense, at $1 per installed horsepower	450,000
Depreciation on equipment, $9,250,000, at 3½ per cent	323,750
Depreciation on structure, $32,816,400 at one-half per cent	164,082
Total	972,832

TOTAL COSTS.

Dam No. 2	$972,832
No. 2 steam plant	816,000
Total	1,788,832

BALANCE.

Income	$4,178,180
Cost	1,788,832
Balance	2,389,348

NOTE.—No charges made for interest, taxes, or insurance.

Combination of Dam No. 2, fifth year (540,000 horsepower installed), and No. 2 steam plant.

SALE OF POWER.

Source.	Horsepower.	Kilowatts.	Load factor.	Kilowatt hours per year.	Rate.	From sale of power.
			Per cent.			
From fourth year						$4,178,180
Secondary, 3 to 4 months, Dam No. 2	90,000	67,500	60	100,000,000	$0.001	100,000
Total				1,534,960,000		4,278,180

PRODUCTION COSTS, DAM NO. 2, WITH 18 UNITS.

Operation of locks and gates	$35,000
Plant operation expense, at $1 per installed horsepower	540,000
Depreciation on equipment, $10,900,000, at 3½ per cent	381,500
Depreciation on structure, $32,816,400, at ½ per cent	164,082
Total	1,120,582

TOTAL COSTS.

Dam No. 2	$1,120,582
No. 2 steam plant	816,000
Total	1,936,582

BALANCE.

Income	$4,278,180
Cost	1,936,582
Balance	2,341,598

NOTE.—No charges made for interest, taxes, or insurance.

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Dam No. 3, first year (72,000 horsepower installed).

SALE OF POWER.

Source.	Horsepower.	Kilowatts.	Load factor.	Kilowatt hours per year.	Rate.	From sale of power.
			Per cent.			
Primary Dam No. 3	34,000	25,500	80	178,704,000	$0.004	$714,816
Secondary, 8½ to 12 months, Dam No. 3	38,000	28,500	80	166,650,000	.002	333,300
Total				345,354,000		1,048,116

PRODUCTION COSTS DAM NO. 3.

Operation of locks and gates	$20,000
Plant operation expense, at $1 per installed horsepower	72,000
Depreciation on equipment, $3,210,000, at 3½ per cent	112,350
Depreciation on structure, $12,785,000, at ½ of 1 per cent	63,928
Total	268,278

BALANCE.

Income	$1,048,116
Cost	268,278
Balance	779,838

NOTE.—No charges made for interest, taxes, or insurance.

Dam No. 3, second year (144,000 horsepower installed).

SALE OF POWER.

Source.	Horsepower.	Kilowatts.	Load factor.	Kilowatt hours per year.	Rate.	From sale of power.
			Per cent.			
Primary Dam No. 3	34,000	25,500	80	178,704,000	$0.004	$714,816
Secondary:						
8½ to 12 months, Dam No. 3	38,000	28,500	80	166,650,000	.002	333,300
5 to 8½ months, Dam No. 3	72,000	54,000	60	150,000,000	.0015	225,000
Total				495,354,000		1,273,116

PRODUCTION COSTS DAM NO. 3.

Operation of locks and gates	$20,000
Plant operation expense, at $1 per installed horsepower	144,000
Depreciation on equipment, $5,420,000, at 3½ per cent	189,700
Depreciation on structure, $12,785,600, at one-half of 1 per cent	63,928
Total	417,628

BALANCE.

Income	$1,273,116
Cost	417,628
Balance	855,488

NOTE.—No charges made for interest, taxes, or insurance.

Dam No. 3, third year (216,000 horsepower installed).

SALE OF POWER.

Source.	Horsepower.	Kilowatts.	Load factor.	Kilowatt hours per year.	Rate.	From sale of power.
			Per cent.			
From second year						$1,273,116
Secondary, 3 to 5 months, Dam No. 3	72,000	54,000	60	95,000,000	$0.001	95,000
Total				590,354,000		1,368,116

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PRODUCTION COSTS, DAM NO. 3.

Operation of locks and gates	$20,000
Plant operation expense, at $1 per installed horsepower	216,000
Depreciation on equipment, $7,630,000, at 3½ per cent	267,050
Depreciation on structure, $12,785,600	63,928
Total	566,978

BALANCE.

Income	$1,368,116
Cost	566,978
Balance	801,138

NOTE.—No charges made for interest, taxes, or insurance.

The CHAIRMAN. How many horsepower in each unit?

Major BURNS. Thirty thousand horsepower.

You will notice that we get less return out of 15 units than we do out of 12 units, even excluding interest charges. In other words, you start in to lose money by putting in more than 12 units.

The CHAIRMAN. Yes. You are trying to utilize too much secondary power.

Major BURNS. Yes, sir; and in the case of the fifth year there is a still greater loss.

The CHAIRMAN. The maximum return comes from your computation there, by an installation of 12 units?

Major BURNS. Yes, sir.

(*d*) Effects caused by changes in assumptions: It is impossible at this time to determine with any great accuracy the conditions under which power would be produced and sold at Muscle Shoals. It should be noted that errors in estimating the probable price or load factor would have a profound effect on the net result of the enterprise.

A change in the price of power amounting to 25 per cent, which in the case of primary power would change the price by 1 mill, will have the result of changing the income from Dam No. 2 by the following amounts: First year, $627,948; second year, $928,295; third year, $1,014,545; fourth year, $1,044,545: fifth year, $1,069,545.

In the same way a reduction in the load factor from 80 and 60 per cent to 60 and 45 per cent, respectively, would have a similar effect. Reductions of this character in both load factor and price would result in reducing the income from dam No. 2 by the following amounts: First year, $1,098,909; second year, $1,624,316; third year, $1,775,454; fourth year, $1,827,954: fifth year, $1,871,704.

The operation of the Muscle Shoals project as an independent power system might result in such unfavorable conditions as those mentioned above. On the other hand, the most efficient use of the power in connection with a large power system might result in a load factor somewhat higher than that used in the computation—i. e., higher than 80 per cent and 60 per cent.

(*e*) Deductions as to values of the Muscle Shoals power development: In the assumptions outlined above and in the calculations no consideration was taken of interest on investment. The following table indicates the interest charges at 4 per cent under the following assumptions:

(*a*) Total additional cost to complete and including interest on capital during construction, but deducting amounts chargeable to navigation as follows: Dam No. 2, $2,860,000; dam No. 3, $5,740,000.

(*b*) Same as above, but not deducting amounts chargeable to navigation.

(*c*) Total costs of projects and including interest on additional capital during construction, but deducting amounts chargeable to navigation as outlined above.

(*d*) Same as (*c*), but not deducting amounts chargeable to navigation.

NOTE.—Total additional cost to complete dam No. 2 with 18 units is taken at $28,500,000, exclusive of interest on capital during construction.

Total cost to complete No. 3 dam is similarly taken at $25,000,000, to which should be added cost of flowage rights taken at $2,331,000.

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Table of interest charges on costs developed in accordance with above assumption.

Item.	(a) Basis.		(b) Basis.	
	Cost.	Interest.	Cost.	Interest.
No. 2 dam plus 4 units	$19,016,400	$760,656	$21,876,400	$875,056
No. 2 dam plus 8 units	21,216,400	848,656	24,076,400	963,056
No. 2 dam plus 12 units	23,416,400	936,656	26,276,400	1,051,056
No. 2 dam plus 15 units	25,066,400	1,002,656	27,926,400	1,117,056
No. 2 dam plus 18 units	26,716,400	1,068,656	29,576,400	1,183,056
No. 3 dam plus one-third of units	18,326,000	733,064	24,066,600	962,664
No. 3 dam plus two-thirds of units	20,536,000	821,464	26,276,600	1,051,064
No. 3 dam plus all units	22,746,000	909,864	28,486,600	1,139,464
Steam plant	6,000,000	240,000	.....	.....

Item.	(c) Basis.		(d) Basis.	
	Cost.	Interest.	Cost.	Interest.
No. 2 dam plus 4 units	$36,016,400	$1,440,656	$38,876,400	$1,555,056
No. 2 dam plus 8 units	38,216,400	1,528,656	41,076,400	1,643,056
No. 2 dam plus 12 units	40,416,400	1,616,656	43,276,400	1,731,056
No. 2 dam plus 15 units	42,066,400	1,682,656	44,926,400	1,797,056
No. 2 dam plus 18 units	43,716,400	1,748,656	46,576,400	1,863,056
No. 3 dam plus one-third of units	18,326,000	733,064	24,066,600	962,664
No. 3 dam plus two-thirds of units	20,536,000	821,464	26,276,600	1,051,064
No. 3 dam plus all units	22,746,000	909,864	28,486,600	1,139,464
Steam plant	.....	.....	.....	.....

Based upon above interest charges, the following tables show the net income that would be derived in accordance with the various assumptions: (A) basis, (B) basis, (C) basis, (D) basis.

Net income.

(A) BASIS.

Item.	Gross income.	Operating and maintenance expense.	(A) basis.[1]	Total costs.	Net income.
No. 2 Dam plus 4 units	$2,511,792	$786,082	$760,656	$1,546,738	$965,054
No. 2 Dam plus 8 units	3,713,180	1,444,082	848,656	2,292,738	1,420,442
No. 2 Dam plus 12 units	4,058,180	1,641,082	936,656	2,577,738	1,480,442
No. 2 Dam plus 15 units	4,178,180	1,788,832	1,002,656	2,791,488	1,386,692
No. 2 Dam plus 18 units	4,278,180	1,936,582	1,068,656	3,867,926	1,272,942
No. 3 Dam plus one-third of units	1,048,116	268,278	733,064	1,011,342	46,774
No. 3 Dam plus two-thirds of units	1,273,116	417,628	821,464	1,239,092	34,024
No. 3 Dam plus all units	1,368,116	566,978	909,864	1,476,842	[2] 108,726

(B) BASIS.

Items.	Gross income.	Operating and maintenance expense.	(B) basis.[3]	Total costs.	Net income.
No. 2 Dam plus 4 units	$2,511,792	$786,082	$875,056	$1,661,138	$850,654
No. 2 Dam plus 8 units	3,713,180	1,444,082	963,056	2,407,138	1,306,042
No. 2 Dam plus 12 units	4,058,180	1,641,082	1,051,056	2,692,138	1,366,042
No. 2 Dam plus 15 units	4,178,180	1,788,832	1,117,056	2,905,888	1,272,292
No. 2 Dam plus 18 units	4,278,180	1,936,582	1,183,056	3,119,638	1,158,542
No. 3 Dam plus one-third of units	1,048,116	268,278	962,664	1,230,942	[2] 182,826
No. 3 Dam plus two-thirds of units	1,273,116	417,628	1,051,064	1,468,692	[2] 195,578
No. 3 Dam plus all units	1,368,116	566,978	1,139,464	1,706,442	[2] 338,326

[1] Interest charges at 4 per cent on total additional cost to complete and including interest on capital during construction but deducting amounts chargeable to navigation as follows: Dam No. 2, $2,860,000: Dam No. 2, $5,740,000.

[2] Loss.

[3] Interest charges at 4 per cent on total additonal cost to complete and including interest on capital during construction and not deducting amounts chargeable to navigation.

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Net income—Continued.

(C) BASIS.

Item.	Gross income.	Operating and maintenance expense.	(C) Basis.[4]	Interest on $6,000,000 at 4 per cent for steam plant.	Total costs.	Net income.
No. 2 Dam plus 4 units	$2,511,792	$786,082	$1,440,656	$240,000	$2,466,738	$45,054
No. 2 Dam plus 8 units	3,713,180	1,444,082	1,528,656	240,000	3,212,738	500,442
No. 2 Dam plus 12 units	4,058,180	1,641,082	1,616,656	240,000	3,497,738	560,442
No. 2 Dam plus 15 units	4,178,180	1,788,832	1,682,656	240,000	3,711,488	466,692
No. 2 Dam plus 18 units	4,278,180	1,936,582	1,748,656	240,000	3,925,238	352,942
No. 3 Dam plus one-third of units	1,048,116	268,278	733,064		1,001,342	46,744
No. 3 Dam plus two-thirds of units	1,273,116	417,628	821,464		1,239,092	34,024
No. 3 Dam plus all units	1,368,116	566,978	909,864		1,476,842	[3] 108,726

(D) BASIS.

Item.	Gross income.	Operating and maintenance expense.	(D) Basis.[5]	Interest on $6,000,000 at 4 per cent for steam plant.	Total costs.	Net income.
No. 2 Dam plus 4 units	$2,511,792	$786,082	$1,555,056	$240,000	$2,581,138	[3] 969,346
No. 2 Dam plus 8 units	3,713,180	1,444,082	1,843,056	240,000	3,527,138	386,042
No. 2 Dam plus 12 units	4,058,180	1,641,082	1,731,056	240,000	3,612,138	446,042
No. 2 Dam plus 15 units	4,178,180	1,788,832	1,797,056	240,000	3,825,888	352,292
No. 2 Dam plus 18 units	4,278,180	1,936,582	1,863,056	240,000	4,039,638	238,542
No. 3 Dam plus one-third of units	1,048,116	268,278	962,064		1,230,342	[3] 182,226
No. 3 Dam plus two-thirds of units	1,273,116	417,628	1,051,064		1,468,692	[3] 195,576
No. 3 Dam plus all units	1,368,116	566,978	1,139,464		1,706,442	[3] 338,326

[3] Loss.

[4] Interest charges at 4 per cent on total cost of projects and including interest on additional capital during construction but deducting amounts chargeable to navigation.

[5] Interest charges at 4 per cent on total cost of projects and including interest on additional capital during construction and not deducting amounts chargeable to navigation.

Senator McKINLEY. As I get it, you figure that Dam No. 2 will bring in about $1,700,000 net rental?

Major BURNS. With what installation, Senator? Did you follow the installation?

Senator McKINLEY. With the figures you gave there.

Major BURNS. Yes; but I gave it for various combinations.

Senator McKINLEY. That would mean on the full installation, would it not, there?

Major BURNS. It depends on what you call full installation.

Senator McKINLEY. I thought you stated that there.

Major BURNS. Without including interest your balance would be $2,341,598.

The CHAIRMAN. That is with 12 units installed?

Major BURNS. That is the entire installation of 18 units.

Senator McKINLEY. Is that net?

Major BURNS. No, sir; that is exclusive of interest.

Senator McKINLEY. It is proposed in one of these leases to pay 4 per cent interest on, say, $25,000,000, as rental, which would be $1,000,000 a year as against $2,700,000 return.

Major BURNS. I will give you that. I have figured out those interest charges.

The CHAIRMAN. You will come to that later, will you?

Major BURNS. Yes, sir. I was outlining the effect caused by the changes in assumptions. As part of a bigger system, of course, you would use the water more efficiently than you otherwise would. These are the deductions

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if you take the interest into consideration. This is on the basis of charging 4 per cent on the additional cost to complete. On that basis your No. 2 Dam, with 4 units, would give you a net income of $850,000 after payment of all expenses, including interest at 4.70; with 8 units it would give you a net income of $1,300,000; with 12 units, $1,366,000; with 15 units, $1,272,000; and with 18 units, $1,158,000. Of course, when you compare that with the Ford offer his return would be a little greater still, because he does not allow a depreciation charge of $160,000 which we allow, and then he does not——

Senator McKINLEY. On your figure, then, there is no economy to put in more than eight units?

Major BURNS. Yes, sir.

The CHAIRMAN. Twelve.

Major BURNS. You make money up to the twelfth unit. After that you are losing money.

Senator McKINLEY. Did you not say $1,360,000?

Major BURNS. Yes, sir. That is for 12 units.

The CHAIRMAN. That is without taking into consideration the possibilities of storage, is it not?

Major BURNS. Yes, sir.

The CHAIRMAN. If it develops later that storage is possible, that would be increased?

Major BURNS. Well, there is a question there, Senator, because when you increase the primary you reduce the secondary, and when you reduce the secondary it seems to me that you are very apt not to require so many of the units for the development of the secondary power.

The CHAIRMAN. Is not this the fact, that to make storage dams you would increase both the primary and the valuable secondary?

Major BURNS. Yes, sir.

The CHAIRMAN. In other words, you would equalize the flow of the river, and that secondary power that is of no value—and there is a great deal of it——

Major BURNS. Yes, sir.

The CHAIRMAN. Would be transformed into a different kind of secondary power that would have value?

Major BURNS. Yes, sir. That is correct.

The CHAIRMAN. And some other secondary would be transformed from secondary to primary.

Major BURNS. That is correct; yes, sir; but it would not prove that you would ever be justified in putting in more than some 12 or 14 units.

The CHAIRMAN. That may be correct. But, for instance, you show there in your table the amount of secondary power that is good for 7½ months in the year?

Major BURNS. Yes, sir.

The CHAIRMAN. That is not worth much as a commercial proposition.

Major BURNS. Not nearly as much as primary power.

The CHAIRMAN. It is not worth as much as if it were available for eight months instead of seven months.

Major BURNS. No, sir.

The CHAIRMAN. If we were to put in storage reservoirs and hold back the floods and make that power that is now available for seven and a half months available for eight months or ten months, that would increase the price you could get for it.

Major BURNS. Yes, sir. That is correct.

The CHAIRMAN. You could not expect to sell power that would be usable only seven months in the year to great advantage. There would have to be some peculiar condition in order to make it of marketable value.

Major BURNS. It is always difficult to secure a market for such secondary power.

The CHAIRMAN. The only object in getting a storage reservoir is to convert secondary power into primary power and also to convert secondary power of no value or little value into more valuable secondary power.

Major BURNS. Yes, sir. On that same basis of calculating the No. 3 dam, we would lose money every year.

The CHAIRMAN. On what basis?

Major BURNS. That we were just talking about, on paying 4 per cent interest on the additional money required to complete.

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The CHAIRMAN. You mean by that it is not a feasible thing, from a financial point of view, to build Dam No. 3?

Major BURNS. Yes, sir. That is what our figures indicate.

The CHAIRMAN. That Dam No. 3 will cost more——

Major BURNS. You will lose money on Dam No. 3, even on these load-factor figures that we have put in and on the values of power. Of course, we have used throughout the high estimates of cost of construction, or the Engineer Department estimates, and if we were able to do it for much less that would have an appreciable effect upon the calculation and perhaps upon the conclusions.

The CHAIRMAN. Is it your opinion, then, that we ought to abandon No. 3?

Major BURNS. I can not see any logic in going ahead with No. 3 at the present time.

The CHAIRMAN. I judge that Colonel Barden did not hold that opinion, although I do not remember asking him directly.

Major BURNS. You can not prove the economic soundness of it, according to our figures. Our assumptions may be wrong.

The CHAIRMAN. Suppose you could develop storage. Would not that have some tendency to make it valuable?

Major BURNS. Oh, yes; because you would increase the amount of primary power, and you might be able to make No. 3 Dam pay for itself on this basis.

The CHAIRMAN. All right.

Major BURNS. These are the deductions we have made after all these studies:

(e) Deductions as to the value of the Muscle Shoals power developments: The following deductions as to the value of the Muscle Shoals power developments are derived from above tables:

1. That in accordance with above assumptions, Dam No. 2 (supplemented by No. 2 steam plant) could sustain itself as a power proposition, even though the total cost of the project plus estimated replacement value of steam plant were charged to power, and even though the maximum estimates of cost are accepted as the true ones. The margin is too small, however, to permit any appreciable reduction in either load factor or selling prices.

2. That Dam No. 2 could pay 4 per cent interest on the additional money required to complete, not deducting anything for navigation, and in addition could net a profit on a basis of 12 units installed of $1,366,000 and on a basis of 18 units nstalled of $1,158,542.

3. That it is not economically valuable to install in excess of 12 units at Dam No. 2 at the present time. (This includes about five months' power.)

4. That Dam No. 3 can not sustain itself as a power proposition if the entire cost of the project is charged to power and when the maximum estimates of cost are assumed.

5. That Dam No. 3 can about sustain itself as a power proposition when maximum estimates of cost are assumed and when deductions for navigation, amounting to $5,740,000, are made.

6. That it is not economically valuable to install in excess of some 110,000 horsepower capacity at Dam No. 3 at the present time.

(This includes power of not less than six months use.)

7. That Dams Nos. 2 and 3 plus steam plant could about sustain themselves as a power proposition, even though the total cost of the project plus estimated replacement value of the steam plant were charged to power, but provided that only 360,000 horsepower capacity were installed at No. 2 and 110,000 horsepower capacity at No. 3. If all capacity were installed, they could not so sustain themselves.

8. That Dams Nos. 2 and 3 plus steam plant could pay 4 per cent interest on additional money required to complete (and not deducting anything for navigation), and in addition could net a profit on most economical power installation of $1,184,000 per year, and on the basis of full installation could net profit of $820,000.

The CHAIRMAN. In your estimate of No. 3 there, Major, where you say it will not sustain itself, you are counting interest at 4 per cent?

Major BURNS. Yes, sir.

The CHAIRMAN. And all the other items as estimated?

Major BURNS. Yes, sir.

The CHAIRMAN. And then you are deducting something over $5,000,000 that is chargeable to navigation?

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Major BURNS. Yes, sir.

The CHAIRMAN. And you are assuming that the flow of the river will remain as it is now and not be increased by the construction of storage reservoirs?

Major BURNS. That is correct; yes, sir.

The CHAIRMAN. Was it the intention of the Government originally, in the very beginning, to construct No. 3 as well as No. 2?

Major BURNS. I don't think any serious intention has ever been expressed by the Government to construct Dam No. 3.

The CHAIRMAN. How did they happen to go to work on it? How did they happen to make those borings? They have spent some money there.

Major BURNS. You are talking about something that I am not informed on; but I should imagine that those borings may have been made after the Ford offer was made to the Secretary of War. I may be wrong about that, but as I recall it I do not think the borings had been made prior to the Ford offer.

The CHAIRMAN. What connection would they have with the Ford offer?

Major BURNS. Because it immediately brought up the question of Dam No. 3.

The CHAIRMAN. Because that was included in his offer?

Major BURNS. Yes, sir.

Mr. LEVERING. Excuse me, but I have a full report on those soundings. They were made before the bid and are included in the report to Congress. There are about a hundred holes, I think. It was all in the report. It was before the Ford offer.

Major BURNS. That concludes the power end.

V. Relation of Muscle Shoals to fertilizers. The following framework is followed:

1. General statement.
2. Quantity of commercial fertilizers used.
3. Cost of commercial fertilizers and the ingredients thereof.
4. Use of concentrated fertilizers.
5. Production of phosphoric acid.
6. Production of inorganic nitrogen and relation thereto of nitrate plants Nos. 2 and 1.
7. Production of potash.
8. Relationship between power and fertilizers.
9. Relationship between Muscle Shoals location and fertilizers.
10. Possibility of Muscle Shoals cheapening the price of fertilizers to farmers.

1. General statement: Ordinarily there are three important elements necessary for plant life which the soil itself is not able to supply in ample quantity, especially after the soil has been used for a considerable period of time in growing crops without well planned rotation thereof. These elements are fixed nitrogen, phosphoric acid, and potash. In some instances only one of the minerals is lacking in the soil, and in some instances two, and generally all three are lacking. The fertilizer industry of the world has been developed for the purpose of replenishing the soil with one or more of these ingredients. In the early days fertility was reestablished by placing back upon the soil animal and vegetable refuse developed on the farm. At this time no other substances were known to have fertilizing value. The development of chemical knowledge has shown, however, that inorganic substances can be used efficiently on the soil to increase its fertility, and as a result of this development the world has started to use in large quantities nitrogen, phosphoric acid, and potash developed from inorganic or mineral sources.

2. Quantity of commercial fertilizers used: The inorganic fertilizer business started its development in the United States about a generation ago, and at the present time has reached a capacity of approximately 8,000,000 tons of commercial fertilizer per year. This quantity is exclusive of the organic fertilizer made and used upon the farm for which no statistics are available. The consumption of commercial fertilizer during the various years and in the various States is about as follows:

FERTILIZER TONNAGE BY STATES.

Following is the list of States showing the consumption of fertilizers for the fiscal years ending in 1913, 1914, 1915, 1916, 1917, 1918, 1919, and 1920, compiled from the most reliable statistics that are obtainable. In some of the States there are absolutely no accurate figures available. For these States indicated

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by an asterisk, estimates have been made, based on information obtained from State officials and fertilizer manufacturers.

State.	Fiscal year ending—	1913	1914	1915	1916	1917	1918	1919	1920
		Tons.	*Tons*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons*
Alabama	Oct. 1	474,730	592,200	302,350	203,000	210,000	289,900	297,903	388,341
*Arizona	June 30	600	650	650	600	500	500	500	500
Arkansas	Sept. 30	52,000	84,850	21,396	65,600	58,500	88,500	64,427	81,875
California	June 30	31,000	39,471	31,540	29,415	43,964	32,03	43,125	58,136
*Colorado	Dec. 31	500	500	600	1,000	1,000	1,000	1,000	1,000
*Connecticut	...do	62,000	74,000	80,000	73,000	78,000	80,000	65,000	65,000
*Delaware	...do	50,000	55,000	45,000	45,000	50,000	54,000	30,398	61,537
Florida	...do	213,728	240,812	208,782	212,250	214,088	197,954	250,613	272,316
Georgia	...do	1,120,693	1,282,088	872,979	741,347	895,897	923,020	990,919	978,090
*Idaho	July 1	200	500	500	500	500	500	500	500
*Illinois	Apr. 30	30,000	40,000	35,000	42,000	45,000	45,000	45,000	45,000
Indiana	Dec. 31	193,899	219,000	151,152	132,159	150,000	244,340	241,000	220,194
*Iowa	Apr. 30	3,500	4,200	5,100	5,000	5,000	5,000	5,000	5,000
Kansas	Dec. 31	7,380	9,400	10,000	7,940	7,000	8,000	16,937	12,650
*Kentucky	...do	75,000	83,000	85,000	62,000	93,000	128,000	103,000	90,000
Louisiana	Aug. 31	98,778	90,588	73,420	95,425	98,214	81,025	97,724	95,904
*Maine	Dec. 31	160,000	168,000	150,000	155,000	160,923	155,000	156,000	168,000
Maryland	...do	169,000	183,350	168,000	154,000	191,900	173,000	174,500	173,000
*Massachusetts	June 30	51,000	54,000	51,000	53,000	64,000	68,000	61,000	61,450
*Michigan	Dec. 31	57,985	60,000	65,000	70,000	91,455	78,000	103,214	112,616
*Minnesota	...do	3,500	3,800	4,000	4,500	4,500	5,000	5,000	5,000
Mississippi	Oct. 1	128,050	127,400	85,414	75,667	76,717	104,700	110,000	139,000
*Missouri	Dec. 31	60,000	65,000	57,000	41,000	65,000	90,000	91,000	120,332
*Montana	No law	800	900	1,000	1,000	1,000	1,000	1,000	1,000
*Nebraska	...do	500	500	500	500	500	500	500	500
*Nevada	...do	800	950	1,000	1,000	1,000	1,000	1,000	1,000
*New Hampshire	Apr. 30	18,000	20,000	16,000	18,000	20,000	18,000	14,000	17,000
New Jersey	Oct. 31	156,661	155,414	153,075	129,800	176,483	153,198	149,485	164,820
*New Mexico	No law	200	200	500	500	500	500	1,500	1,500
*New York	Dec. 31	380,000	420,000	400,000	400,000	420,000	430,000	410,000	400,000
North Carolina	Dec. 1	840,447	872,820	647,188	650,000	849,728	921,962	961,238	1,221,796
*North Dakota	Dec. 31	500	550	600	700	1,000	1,000	1,000	1,000
Ohio	...do	183,476	203,000	225,000	187,848	165,857	219,328	305,236	300,000
*Oklahoma	June 30	2,000	2,000	2,000	3,000	3,000	3,000	4,000	4,000
*Oregon	Aug. 30	4,500	6,300	6,500	6,500	7,000	6,000	7,500	5,500
Pennsylvania	Dec. 31	340,000	381,900	316,319	268,455	334,309	340,898	340,000	326,864
*Porto Rico	June 30	18,836	18,164	20,000	37,725	45,767	40,811	21,815	20,000
*Rhode Island	Mar. 31	9,000	12,500	11,000	12,000	11,500	10,000	9,000	10,000
South Carolina	June 30	918,336	1,095,728	670,610	833,624	850,790	1,064,886	1,033,887	1,253,890
*South Dakota	July 1	700	1,000	1,500	1,500	2,500	2,500	3,000	3,000
Tennessee	May 31	84,060	93,550	77,390	91,128	99,584	113,000	109,366	112,202
Texas	Sept. 1	75,500	77,400	17,500	39,845	40,500	58,000	46,000	56,700
*Utah	Dec. 31	1,000	1,200	1,500	1,000	1,000	1,000	1,000	1,000
*Vermont	June 30	14,500	18,000	13,500	15,000	14,500	16,000	18,000	20,000
Virginia	Dec. 31	412,434	437,808	406,077	369,520	496,217	430,549	421,484	429,024
*Washington	Mar. 31	1,500	2,400	3,000	3,000	4,000	4,010	4,000	4,000
West Virginia	June 30	31,852	35,475	46,010	40,000	41,000	59,036	63,000	121,052
*Wisconsin	Dec. 31	4,000	4,500	5,000	5,000	6,500	7,500	10,000	12,000
Wyoming	No law	200	400	500	500	500	500	500	500
Total		6,544,345	7,340,528	5,563,212	5,390,549	6,206,543	6,756,743	6,891,322	7,654,239
Hawaii	June 30	67,000	80,000	70,000	65,000	80,000	64,000	71,000	70,000

* Fertilizer consumption for 1921 was 4,500,000 tons.

The Chief of the Bureau of Soils believes that the country could well afford to use, at the present time, some 16,000,000 tons of fertilizer per year if the price were sufficiently satisfactory. There is no doubt but what the tonnage of fertilizer will expand with time.

3. Cost of commercial fertilizer and the ingredients thereof: The cost of fertilizer to the farmer is dependent primarily upon the quantities of the various ingredients contained in the mixed fertilizer which he receives. The price fluctuates from year to year. At the present time the cost of fertilizer containing some 2 per cent nitrogen, 8 per cent phosphoric acid, and 2 per cent potash, to the farmer is some $25 to $30 a ton. The total commercial fertilizer bill of the farmer on this basis is some $200,000,000 to $240,000,000 per year. In accordance with testimony of the Chief of the Bureau of Soils Department of Agriculture, the cost to the farmer of 1919 commercial fertilizer tonnage was $225,000,000. In accordance with data obtained from the Department of Commerce, the cost to the farmer of 1914 fertilizer tonnage, or 8,430,000 tons, is $153,000,000; and of the 1919 tonnage, or 8,290,000 tons, $280,000,000.

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Any one of the three essential elements can be used on the farm separately and with value to the farmer provided, of course, that the soil on which it is used needs that particular element. Large quantities of various materials are used in this way. For this reason it is not easy to make a statement as to what the average content of each of the various elements of the total tonnage of fertilizer is. It seems to be the concensus of opinion, however, that the total fertilizer tonnage can be figured as containing an average content of not less than 2 per cent nitrogen, 8 per cent phosporic acid, and 2 per cent potash. This would give a consumption of 160,000 tons of nitrogen per year, 640,000 tons of phosphoric acide per year, and 160,000 tons of potash per year. On this basis, from the standpoint of cost to the farmer, the nitrogen represents about 52 per cent of the total cost of ingredients, phosphoric acid 35 per cent, and potash 13 per cent. These percentages are developed by assigning to nitrogen a unit value of $3.65 (the equivalent of a unit value of $3 for ammonia), the phosphoric acid a unit value of 50 cents, and potash a unit value of 70 cents. A unit represents 20 pounds or 1 per cent of the ton.

Some authorities believe that the average fertilizer contains larger quantities of nitrogen and potash than outlined above. This would immediately affect the quantities of the various materials used and the ratio of cost to the farmer. If we assume that the average fertilizer is 3 per cent nitrogen, 8 per cent phosphoric acid, and 3 per cent potash instead of 2–8–2, as indicated above, the quantity of nitrogen is increased from 160,000 tons per year to 240,000 tons. Similar increase takes place in the case of potash. With the same unit costs, the percentages of total cost of ingredients to the farmer of the three ingredients are as follows:

	Per cent.
Nitrogen	60
Phosphoric acid	26
Potash	14

The cost of assembling ingredients, mixing them, and distributing them to the users, including sales expenses, profits, etc., amounts to some 50 per cent of the entire fertilizer bill. This shows the large possibility to the farmer of reducing the cost of fertilizers through "home" mixing of the ingredients. "Home" mixing might reduce the price of fertilizer in some instances by one-third and on the average by some 10 to 15 per cent.

In other words, that has great possibilities in it. It has been recommended for years.

Transportation charges cost the farmer some 30 to 40 per cent of the entire fertilizer bill. Those transportation charges include the freight on the ingredients as well as freight on the finished mixed fertilizer.

4. Use of concentrated fertilizers: On the basis of 2–8–2 commercial fertilizer contains only 12 per cent plant food. On the basis of 3–8–3 the fertilizer contains only 14 per cent plant food. The balance in either case, or some 86 to 88 per cent, is either carrier or filler. The greater part is natural carrier, which can not be eliminated under present fertilizer practice; for instance, ammonia, which is one of the important fertilizer ingredients, inasmuch as it is over 80 per cent nitrogen, can not be placed on the farm as such; it is a gas and must therefore be combined with a carrier. The present carrier is sulphuric acid, and the resultant material is ammonium sulphate. In the sulphate the ammonia content is only 24 per cent and the balance, or 76 per cent, is necessary carrier. In the case of several other ammonia compounds the percentage is much less. Similarly potash and phosphoric acid have carriers which have no other fertilizer value in the present-day fertilizer system. In addition to these carriers, the fertilizer companies in many cases add a small amount of inert filler to make the proportions correct, so that the finished material purchased by the farmer will be of the proper grade and composition; as, for instance, 2 per cent nitrogen, 8 per cent phosphoric acid, and 2 per cent potash, or perhaps 1 per cent nitrogen, 8 per cent phosphoric acid, and 3 per cent potash. A concrete example may help to make this clear. If it is desired to make a mixture containing 2 per cent of ammonia, 8 per cent of phosphoric acid, and 2 per cent of potash (the well-known grade 2–8–2) and the materials at hand are cottonseed meal, containing 7 per cent of ammonia, acid phosphate, containing 16 per cent of phosphoric acid, and Nebraska potash, containing 28 per cent of potash, the method of making up the mixture will be as follows: 2 per cent of a 2,000-pound ton is 40 pounds; in order to obtain 40 pounds of ammonia from 7 per cent cottonseed meal it will be necessary to

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use 571 pounds of cottonseed meal. The amount of phosphoric acid desired is 8 per cent of a ton, or, in fertilizer parlance, 8 units, or 160 pounds. To obtain 160 pounds from a 16 per cent acid phosphate will require 1,000 pounds of acid phosphate. The amount of potash called for is 40 pounds, and to obtain that from a 28 per cent material 143 pounds will be required. The total amount of materials used, therefore, will be 571 plus 1,000 plus 143, or 1,714 pounds. To this are added 286 pounds of filler in order to make up the ton.

It seems to be the consensus of opinion that one of the greatest possibilities for cheapening the cost of fertilizer to the farmer is to use more concentrated fertilizer, which would at once materially reduce freight which the farmer has to pay, as a large part of the useless materials now transported by freight might be eliminated. While it is possible with present-day fertilizer systems to use more concentrated fertilizers on the average than are to-day being used, it would not be possible to use highly concentrated fertilizers without installing practically a new system of fertilizer manufacture and distribution in America. If the insertion of filler in the present-day fertlizer could be satisfactorily eliminated, that in itself would reduce the quantities of useless materials that are transported from the fertilizer mixing plants to the farmer. This would not amount, however, in excess of some 200 or 300 pounds per ton in the average mixed fertilizer, and it would eliminate freight only from the mixing plant to the farmer and in the ordinary case this mileage is not very great. But it is not easly to eliminate even all of this filler.

But by far the greater opportunity lies in the substitution of useful for useless carriers. It so happens that ammonia and phosphoric acid, both concentrated plant foods, can be combined and would serve each other as carriers. Similarly, potash and phosphoric acid, again both concentrated plant foods, can be combined and would also serve each other as carriers. By using such materials a combination can be formed of ammonia phosphate, potassium phosphate and ammonium nitrate which would give a concentrated mixture containing approximately 75 per cent of real plant food as against the 12 or 14 per cent contained in present-day fertilizers, and an average maximum of some 16 or 17 per cent that might be contained in present-day fertilizers if the filler were in all cases elminated. Such concentrated fertilizer should not be directly applied to the soil but should be diluted with some substance in order to prevent the damage that might be caused by overfeeding of the plant due to uneven distribution. It so happens that these concentrated fertilizer materials can be diluted with water, as all of them are soluble in water. Therefore, if the farmer should dissolve this concentrated plant food in the proper quantity of water he could sprinkle the solution on the soil in such a way as to most benefit the plant.

Such a scheme as the above for the utilization of concentrated fertilizer seems to be one of the main hopes of the Agriculture Department and of other people strongly interested in helping the farmer. It is contrary, however, to the present system in which the fertilizer companies do the mixing and send to the farmer a substance which he can apply to the soil without modification. It is, furthermore, essentially dependent upon the availability in large quantities of cheap phosphoric acid. Such material can not be produced at the present time at a satisfactory price, and it is to be remembered that this country has been endeavoring to produce such cheap phosphoric acid for a generation. The concentrated fertilizer solution can, therefore, be brought about only by gradual evolution.

As I said before, the question of cheaper phosphoric acid is a very vital one. I have felt myself that there has not been testimony before the committee to prove that a cheaper phosphoric acid can be produced.

5. Production of Phosphoric Acid: At the present time phosphoric acid is derived from the phosphate rocks of Tennessee and Florida. These rocks are treated with sulphuric acid with consequent development of acid phosphate. This acid phosphate contains about 16 per cent phosphoric acid, which can be extracted by the plant from the acid phosphate. Inasmuch as the sulphuric acid which is combined with the phosphate rock in about an equal quantity is of no use to the soil it has been the endeavor of the agricultural people for many years to obtain a phosphoric acid which is free from sulphuric acid and which can be made available to the farmer at no greater expense. Phosphate rock can be treated in the electric furnace and concentrated phosphoric acid produced. The Agriculture Department and private plants have been experimenting with such a process for some time. Testimony indicates that the Federal Phosphorus Co. of Anniston, Ala., has sufficiently perfected an electric-

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furnace phosphoric acid so that it can compete in the food markets only with phosphoric acid manufactured by means of sulphuric-acid processes. The president of such company entertains great hopes that with cheap power phosphoric acid can be manufactured so cheaply by the electric-furnace process as to allow such material to compete in the fertilizer trade with the acid phosphate at present produced with sulphuric acid. If this scheme could be developed, Muscle Shoals, provided it can produce sufficiently cheap power, might assist in the development of cheaper phosphoric acid, one of the essential plant foods. Such material might, in turn, assist in bringing about in America the early use of concentrated fertilizers. This scheme of concentrated fertilizers is, to repeat, in great measure dependent upon the production of cheap phosphoric acid. It is against pointed out that it costs some $70 per ton of nitrogen to convert ammonia into ammonium sulphate. This is approximately 25 per cent of the selling price of nitrogen in the form of sodium nitrate or ammonium sulphate.

6. Production of inorganic nitrogen and relation thereto of nitrate plants Nos. 2 and 1: As already pointed out, there are three sources of inorganic nitrogen, namely, by-product coke oven ammonia, nitrate of soda, and air nitrogen fixation products. Repeating again, nitrogen fixation must sooner or later become one of the principal sources of inorganic nitrogen, and the business must be established in the United States. Muscle Shoals could affect only this latter source of material.

The conclusions as to costs of fixing nitrogen in competition with ammonium sulphate and Chilean nitrate when such fixation was done in new plants of the cyanamid, the Haber-Bosch, and the Haber electrolytic processes were outlined in a preceding chapter.

These conclusions were to the effect that with present knowledge and under the present fertilizer system neither new cyanamid plants nor new Haber-Bosch plants would be expected with power at zero to show any appreciable profit in competition with the average prices of nitrogen much less to reduce the prices thereof. A new Haber electrolytic plant could about break even on 3-mill power and should show a profit of $18 per ton or 6.3 per cent for every reduction of 1 mill in the price of power. Even with no interest charges on the replacement value of the No. 2 plant, which interest charges are taken at $30 per annual ton of nitrogen produced, the No. 2 plant, making ammonium sulphate by the cyanamid process, could only break even in competition with the average price of ammonium sulphate if power cost 2 mills per kilowatt hour. With power at 1 mill it could make a profit of $15 per ton of nitrogen, or about 3 per cent. The No. 2 plant can produce materials of fertilizer value other than ammonium sulphate, and developments may prove that they can be made at a satisfactory price. Such a condition does not exist at the present time.

If the No. 2 plant were converted into a Haber electrolytic plant it is believed that it could be accomplished at a cost of $250 per ton of nitrogen capacity as against the estimated new cost of $485 per ton. This reduction is caused by availability of facilities of various kinds, by the availability of necessary liquid air plant, by availability of power, of buildings which could be used, etc. On basis of 40,000 tons' capacity this would amount to a saving of $9,400,000 in capital cost and a reduction in cost of producing nitrogen—in form of ammonium sulphate—by $14.10 per ton of nitrogen. (This assumes a reduction of 6 per cent interest on saving in construction cost of $235 per ton capacity. Other charges would remain the same.)

The CHAIRMAN. Now, Major, you would not advise us to do that with No. 2 until it has been first demonstrated by the use of No. 1 as an experimental plant that it was a practical proposition?

Major BURNS. I should say that a progressive method would be the best way to tackle it.

The CHAIRMAN. In other words, we would not want to destroy No. 2 because of its war possibilities for explosives until we absolutely knew that by its destruction and dismantling we could improve and make the thing cheaper?

Major BURNS. Yes, sir; and that is a very good point. You ought to go to any of these new processes by steps.

The CHAIRMAN. The idea, I take it, would be to use No. 1, remodel that, and then operate it for a time and see what it will do, and not dismantle No. 2 or transform it until we know from actual experience that No. 1, that we would improve, would be usable.

Major BURNS. Of course, this Haber electrolytic system is a rather easy system to operate. The big difficulty with the Haber water-gas system is that you

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get a great many impurities in your gases. After you get the hydrogen and the nitrogen they are so impure that you have got to work on them a great deal in order to eliminate these poisons. It is one of the most difficult parts of the process. In the Haber electrolytic process, on the other hand, the gases are obtained in a very pure state. The nitrogen is obtained in the same way as at No. 2 plant, or by fractional distillation of air. The hydrogen is obtained by the electrolysis of water. There is no question as to the ability to do this. It is just a question of cost. We know we can break water down by electrolysis into its elements. That, of course, has been established for many years. The welding of the gases is done in the same way in either process. However, I think the scheme of going to your ultimate plant by moderate steps is a sound one.

The CHAIRMAN. Of course, we have that cyanamid plant there, No. 2, as a war proposition. It was constructed as a war proposition. We realized that the probabilities are that the improvement and cheapening of the extraction of nitrogen from the air is going to come from the Haber process, or a modification of it; but until we know it we would not want to destroy plant No. 2, so that in case of war we could not utilize that, although it would be expensive, but it would be much better than not having anything.

Major BURNS. On the basis of 2-mill power the No. 2 plant, if modified to use the Haber electrolytic process, might therefore make a saving of $32 per ton of nitrogen on the average selling price thereof in the form of nitrate of soda or ammonium sulphate, or 10½ per cent of such selling price. If this were all applied to commercial fertilizers of 2–8–2 composition it would make a saving per ton of about 64 cents or approximately 2 per cent. United States Nitrate Plant No. 1 is not at present able to fix nitrogen. To round out the plant by the Haber electrolytic process so that it could produce ammonia up to its rated capacity, or the equivalent of 8,000 tons of nitrogen per year would cost about three-fourths as much as a new plant, or some $360 per ton year capacity of nitrogen. The new capital saving would be about $1,000,000. The saving in cost of production in this case would amount to the interest on $125 or $7.50 per ton of nitrogen. This amounts to about 2½ per cent of the selling price of nitrogen and practically vanishes in the case of a commercial fertilizer.

The developments of the future, and most people seem to think that important improvements and inventions are bound to occur in this connection, may give us new processes or modifications of old ones which will materially cheapen the price of available air-fixed nitrogen.

6. Production of potash: Potash at the present time is obtained through importations from deposits in Alsace and in Germany. Potash exists in large quantities in the United States but in an insoluble form in shales and mineral rocks. It is possible to extract this potash from such rocks and make it available as plant food by means of the electro furnace and other methods. As to whether this can be done at a cheaper price than that which we must pay Germany, is not yet proved although one witness—Mr. Edison—has indicated that he can produce potash from rocks at a price which is nearly as low as that now paid Germany, and he further believes that he can reduce such price. Here, again, cheap power might have an appreciable effect upon the cost of the third of the essential elements.

7. Relationship between power and fertilizers: One of the big advantages that has always been claimed for Muscle Shoals in the cheapening of fertilizers is the possibility of cheap power. It is important, therefore, to understand the relationship between power and fertilizers. To fix one ton of nitrogen by the various processes with present knowledge requires the following quantity of power:

Kilowatt hours required per ton of nitrogen.

Process:	
Cyanamid	15,000
Haber-Bosch (water-gas hydrogen)	4,000
Haber electrolytic (hydrogen from electrolysis of water)	18,000

To produce 1 ton of phosphoric acid from phosphate rock by the electric furnace with present knowledge requires 6,000 kilowatt hours.

Knowledge is not available as to power required to produce potash from potash-bearing shales.

One mill per kilowatt hour in the price of power, therefore, has the following effects on the price of a ton of nitrogen or a ton of phosphoric acid: Cyanamide process, $15 per ton of nitrogen; Haber-Bosch process, $4 per ton of nitro-

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gen; Haber electrolytic process, $18 per ton of nitrogen; electric furnace, phsphoric acid, $6 per ton of phosphoric acid.

On the basis of a fertilizer containing 2 per cent nitrogen and 8 per cent phosphoric acid, the effect on 1 mill per kilowatt hour in the price of power would have the following effects in the price of commercial fert.lizers: Cyanamide process, $0.30 per ton; Haber-Bosch process, $0.08 per ton; Haber electrolytic process, $0.36 per ton; electric furnce, phosphoric acid, $0.48 per ton; 100,000 continuous horsepower, through the cyanamide process, will fix approximately 40,000 tons of nitrogen per year as ammonia, which latter quantity is about 25 per cent of the nitrogen at present used in commercial fertilizers; 100,000 continuous horsepower through the Haber electrolytic process will fix approximately 32,000 tons of nitrogen per year or about 20 per cent of the present consumption; 100,000 continuous horsepower would produce in the electric furnace about 110,000 tons of phosphoric acid per year or about 16 per cent of the present consumption.

9. Relationship between the Muscle Shoals' location and fertilizers: Muscle Shoals is located in a region which consumes large quant ties of fertilizers. A table has been inserted to show the consumption by States. The consumption within the neighboring States of Tennessee, North Carolina, South Carolina, Georgia, Alabama, and Mississippi is over half of the consumption within the United States. These are included within a maximum radius of about 800 miles. From Muscle Shoals to the seaboard, covered by these States, represents an average distance of some 400 miles. From the standpoint of rail transportation the location of Muscle Shoals should, therefore, be economical within a raduis of some 200 to 250 miles. In other words, if fertilizers could be manufactured as cheaply at Muscle Shoals as the present commercial fertilizers are produced, the region within a radius of some 200 to 250 miles of Muscle Shoals should get its fertilizers at a cheaper rate than at present. If they could be produced more cheaply this zone would increase and vice versa. This area is using, probably, less than 1,000,000 tons of fertilizer or less than one-eighth the total consumption, while Muscle Shoals could make about one-fourth the nitrogen now used in fertilizers. Navigation development of the Tennessee River might also extend this zone. The development of a concentrated fertilizer would extend this zone. Muscle Shoals is also within about 100 miles by rail from the phosphate-rock deposits at Columbia, Tenn. The transportation of this material to Muscle Shoals for working would probably be about the same as the present costs of tranporting phosphate rock from the Florida mines to the Atlantic seaboard. Potash, bearing shales, also exist in the near vicinity. The nitrogen of the air is, of course, equally available to all locations.

10. Summary of the possibility of Muscle Shoals cheapening the cost of fertilizers to the farmer: Some 55 per cent of the total cost of ingredients in fertilizers is chargeable to nitrogen, 30 per cent to phosphoric acid, and 15 per cent to potash. The cost of ingredients represents about 50 per cent of the cost of fertilizer to the farmer. To collect the ingredients, mix them, and distribute them, including sales expenses, profits, etc., represents about 50 per cent of the cost of fertilizers to the farmers. The transportation costs which are included in the above costs of ingredients as well as in the collection and distribution costs amount to some 30 to 40 per cent of the cost of fertilizer to the farmer. The carrier, namely, sulphuric acid, which is used to make ammonia available as fertilizer materials, represents a large item of cost. This sulphuric acid has no fertilizer value.

In the matter of ingredients, Muscle Shoals, on the basis of converting the No. 2 plant into a Haber electrolytic plant and with power at two mills and allowing for all costs including interest, depreciation, insurance, taxes, etc., but not allowing for profits, might save $32 per ton of nitrogen on the average selling price over the 1900–1914 period and also the present price, namely, $281 per ton. This amounts to some 10½ per cent of such price. If this saving were all given to the farmer it would amount to a yearly saving of $1,260,000, or about one-half of 1 per cent of the total fertilizer bill. And if such production forced a reduction of $32 a ton on all nitrogen consumed in fertilizer, the total saving to the farmer would be some $5,000,000 to $6,000,000, or some 2 to 3 per cent of present fertilizer bill.

In the case of phosphoric acid, present knowledge does not justify the statement that any savings can be made because no evidence is available that phosphoric acid can be produced sufficiently cheaply by electro-furnace meth-

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ods to warrant its use in fertilizer in competition with acid phosphate produced by sulphuric acid.

In the case of potash no savings can be made with present knowledge. In the matter of collecting, mixing, distributing, and selling mixed fertilizer which costs about 50 per cent of the total cost of fertilizers, the greatest benefit can be obtained by "home" mixing by the farmer himself. By this means he might be able to reduce his costs some 10 to 15 per cent. Muscle Shoals might have some beneficial effect in this respect but it is difficult to measure it.

Exclusive of rate consideration, transportation charges can be reduced in general by reducing the quantity hauled or by reducing the length of haul. The quantity hauled could best be reduced by increasing the strength of fertilizers and thus reducing the quantity of useless materials transported. This is in great measure dependent upon cheap phosphoric acid, which is a hope but not a reality. Length of haul could be reduced by manufacturing the ingredients and the fertilizers in the near vicinity of their use. If Muscle Shoals could equal the price of present commercial fertilizers or the ingredients thereof, it could affect favorably the price of fertilizers within a radius of about 200 to 250 miles of Muscle Shoals.

In the matter of carrier, it costs some 20 per cent of the cost of nitrogen to convert ammonia into ammonium sulphate. This costs the farmer, exclusive of transportation charges, some $7,000,000 per year. With cheap phosphoric acid, some $5,000,000 of this cost could be saved. But while cheap power is necessary to cheap phosphoric acid, there is no assurance at present that Muscle Shoals can satisfactorily solve this problem.

To sum up on basis of present knowledge, Muscle Shoals does not offer any reasonable expectation of even appreciably reducing the average price of fertilizers to the general farmer of the country. It does offer some hope of reducing the price of nitrogenous fertilizers only to the farmers living within a radius of some 200 miles of Muscle Shoals. It can make available to the fertilizer trade, at a price equal to present price and pre-war average, some 25 per cent of the present tonnage of nitrogen used in commercial fertilizers. With the extensive and intensive research and development that might go with the establishment at Muscle Shoals of a large and new fertilizer business important and beneficial improvements in the methods of manufacture, distribution, and use of fertilizers might ensue.

VI. Relation of Muscle Shoals to munitions preparedness. The following framework is followed:

1. Importance of fixed nitrogen to munitions.
2. Source of nitrogen for munitions purposes.
3. General solution of munitions preparedness.
4. Application of general solution to nitrogen preparedness.
5. Relation of Muscle Shoals to nitrogen preparedness. (*a*) United States nitrate plant No. 2; (*b*) hydroelectric development.

1. Importance of fixed nitrogen to munitions: Fixed nitrogen is an essential ingredient of smokeless powder, black powder, T. N. T., and practically every known type of military high explosives. It is also an essential ingredient of many of the poisonous gases used in the World War. Therefore no gun can be fired or no shell, bomb, or torpedo exploded without the use of fixed nitrogen, and without these types of ammunition the present-day army or navy would be helpless. An adequate supply of fixed nitrogen is, therefore, of basic importance, and we must not only provide a supply for munitions but also for indispensable industries and fertilizers.

2. Sources of nitrogen for munitions purposes: As already stated, there are three sources of supply of fixed nitrogen for munitions purposes, namely, Chilean nitrate, by-product coke ovens, and fixed atmospheric nitrogen. The first of these is a foreign source and therefore can not be depended upon in case of war. If we did not have to fear the stoppage of importations we would have no military nitrogen problem. Our supply must be assured from the two latter sources.

By-product coke ovens are to-day producing about 60 per cent of the coke used in the United States and about 100,000 tons of fixed nitrogen per year. Some further peace-time expansion will take place and is very much to be desired from the standpoint not only of preparedness for war but also of the economical utilization of the resources of nature. But the war-time expansion of this source of nitrogen should not be relied upon solely to supply our probable war requirements of nitrogen. By-product ovens are difficult and ex-

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pensive to build and their expansion in excess of the market requirements for coke, their principal product, could only be justified if no cheaper sources of nitrogen and of other necessary by-products were available. For the production of nitrogen only, there is a cheaper source, and this is by the fixation of atmospheric nitrogen. The satisfactory development of nitrogen fixation is therefore a paramount importance from the standpoint of war preparedness.

3. General solution of munitions preparedness: The World War has very definitely emphasized the fact that new man power can be mobilized, trained, and placed on the battle front at a much more rapid rate than can munitions be manufactured, assembled, and delivered to the fighting forces at the battle front.

While the time interval varies with different types of munitions, it can be stated in general that it requires on the average some 12 months longer to deliver new munitions to the battle front than it does to deliver new man power. In the case of nitrogen it is not less than 17 months.

Proper war preparedness required therefore that we keep on hand in war reserves sufficient stocks of the essential munitions of various kinds to supply our probable war army until new production is adequate.

The above principle is of basic importance in any policy of national preparedness. If it is not followed out we are certain to be forced in time of war to send our troops to battle with inadequate supplies of fighting materials.

4. Application of general solution to nitrogen preparedness: In the case of nitrogen, as already stated, it requires some 17 months to construct new nitrogen fixation plants and get their product to powder and explosive plants, convert these materials into ammunition and get the ammunition to the battle front in sufficient quantity to meet the probable demands of a war army.

The demand during that time must, therefore, be made up from stocks on hand and from the production that can be obtained from available facilities. In the judgment of the Ordnance Department the nitrogen production of by-product coke ovens plus commercial stocks of nitrogen should be sufficient to care for the needs of the essential industries and of fertilizers in case of a defensive war. War requirements for munitions purposes would have to be met by the war reserve stocks of nitrogen in various forms, such as nitrate of soda, smokeless powder, high explosives, ammunition, etc., and by the production of nitrogen fixation plants. The quantities of stocks and facilities required depend upon the probable war requirements which are not easy of determination, as they are dependent upon the enemy or combination of enemies that we may be called upon to fight.

With increased availability of nitrogen-fixation plants we would be justified in reducing our war reserves, and vice versa. The present approved policy of the War Department for the assurance of an adequate supply of nitrogen for munitions purposes requires the retention of certain stocks of nitrate of soda, powder, explosives, ammunition, etc., and, in addition, the maintenance in stand-by at least of United States nitrate plant No. 2 until an adequate supply of nitrogen is assured by the commercial development of nitrogen fixation.

5. Relation of Muscle Shoals projects to nitrogen preparedness, (*a*) United States nitrate plant No. 2: This plant plays a very important part in the nitrogen solution. It can fix sufficient nitrogen to supply constantly some 12 divisions which would be organized, equipped, and fought in the same way as the World War divisions. As an indication of the importance of this statement it is to be noted that our maximum military effort of the World War, or the Meuse-Argonne offensive, used only 30 divisions.

In pursuance of the policy outlined above, this plant would only be retained in stand-by until we are assured of an adequate supply by commercial development. The cost of pursuing such a policy is of importance, and while it is very difficult of determination, it has been outlined by the Ordnance Department as follows:

"The cost can be divided into two classes: Those required for depreciation or replacements, and those required for caretaking force.

"Depreciation and obsolescence charges.

"In the case of Government reserve plants high depreciation and obsolescence charges are not justified. Depreciation charge of some 5 per cent on the replacement value of the plant is justifiable in the case of a commercial plant. This is so because the plant will have to keep thoroughly up to date in the art, so that it will be comparable in efficiency with the latest developments. This condition is not necessarry in war reserve plants. In these latter surety of production is the important point, and the economy of production is not vital, as the war operation would last a comparatively short time. In the case of a

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war reserve plant, therefore, the depreciation charge amounts to the cost of making such necessary replacements as would keep the plant available for operation.

"The Ordnance Department believes that during the first 20 years of the life of the United States nitrate plant No. 2 necessary replacements could be financed for a total of $2,000,000 or an average of $100,000 a year. After that date replacements would undoubtedly rapidly increase in cost. The Ordnance Department does not feel, however, that it would be necessay in any case to retain nitrate plant No. 2 for a greater period of time than 20 years, for it feels that within such a time nitrogen fixation will become an established commercial business and that the Government will be justified in depending upon such business for its supply of nitrogen in case of need. However, if the period is extended to 100 years, it is proable that replacement charges over the entire 100 years would, in the case of the No. 2 plant, cost approximately $40,000,000, or an average of $400,000 per year.

"Care-taking charges: It is believed that the care-taking forces of nitrate plant No. 2 can be financed with an expenditure of $100,000 per year.

"Total cost: The total cost of maintaining nitrate plant No. 2, therefore, amounts to $200,000 per year, if we assume that it will be required for a period of 20 years. It amounts to $500,000 per year, if we assume that it will have to be maintained for a period of 100 years.

"Deductions: As an offset to these costs, the steam plant of nitrate plant No. 2 can undoubtedly be leased at an appreciable rental. At the present time it is under lease to the Alabama Power Co. at a fixed rental charge of $120,000 per year, to which should be added 2 mills for each kilowatt-hour of power generated, which may bring the total rental up to some $200,000 per year. The expenditures outlined above would be decreased by the amount of this return."

During any year this plant should, under full operation, produce some 40,000 tons of nitrogen. Starting from stand-by condition it could probably produce only about one-half that amount. The maintenance of the plant in an operating condition is, therefore, from this point of view alone, more valuable to the Government than its retention in stand-by; and in addition, operation should make it more surely available, provided, of course, that it were not allowed to run down. The same preparedness under an operating condition might be achieved by reducing our reserve stocks. It is not believed, however, due to the many complications of ammunition manufacture, that our war stocks of sodium nitrate should be allowed to fall below some 100,000 to 150,000 tons.

(*b*) United States nitrate plant No. 1: The United States nitrate plant No. 1 is not a thoroughly developed plant and is not dependable as a source of supply of fixed nitrogen at the present time. It is not believed, therefore, to be of sufficient value to the War Department to retain it as a reserve plant. It would undoubtedly be proper from the military standpoint to perfect this synthetic or Haber process and have it ready in case of an emergency, except for the fact that the Air Nitrates Corporation has satisfactorily developed the process at their Syracuse plant. It is believed, therefore, that nitrate plant No. 1 can be disposed of without restriction from the standpoint of military preparedness.

(*c*) Hydroelectric development: World War experience showed that one of the most difficult materials to obtain was power. The chemical part of the United States nitrate plant No. 2 was started in February, 1918, and was essentially complete at the time of the armistice, or November, 1918. However, the large 60,000-kilowatt steam plant at nitrate plant No. 2 was not ready for service for several months thereafter. By the cyanamid process 100,000 horsepower will fix sufficient nitrogen for about 12 divisions. The Muscle Shoals hydroelectric development from the power standpoint would, therefore, be a very important war reserve; in fact, it is probably the most important element of preparedness in connection with the Muscle Shoals development.

VII. General summary:

1. The Muscle Shoals project is divided into two parts, namely, the nitrate plants and the hydroelectric developments in the Tennessee.

2. The nitrate plants consist of nitrate plant No. 1 located at Sheffield, Ala., and nitrate plant No. 2 located at Muscle Shoals, Ala., together with its adjuncts, namely, the Gorgas power plant located on the Black Warrior River at Gorgas, Ala., the Warrior-Sheffield transmission line connecting this power plant with nitrate plant No. 2, and the Waco limestone quarry located near Russelville, Ala.

The hydroelectric developments consist of the Wilson Dam.

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3. Four main considerations affect the future of the project, namely, (a) Nitrogen preparedness in case of war; (b) Navigation in the Tennessee River over Muscle Shoals section; (c) Hydroelectric power development; (d) Manufacture of fertilizer.

4. Nitrogen preparedness in case of war.

The War Department believes that the best nitrogen preparedness is the development of the commercial business of nitrogen fixation in America. Until such development has reached a dependable status, the War Department believes that United States nitrate plant No. 2 or its equivalent in nitrogen fixation capacity should be available to the Government. From this point of view it would be possible for the Government to dispose of United States nitrate plant No. 1, the Gorgas power plant, and the Warrior-Sheffield transmission line, and to lease or sell the remainder of plant No. 2 under the provision that it would be available in case of need. From this point of view also hydroelectric developments in the Tennessee are not necessary although very desirable.

2. Navigation on the Tennessee River over Muscle Shoals section: The value of navigation development at Muscle Shoals is somewhat doubtful. It has, of course, many advocates. The amount of river traffic at present is small but navigation facilities are poor. With adequate facilities, traffic commensurate with the cost of developing navigation might follow. A fair channel at present exists from the mouth of the river to Muscle Shoals and can be made into a 5 or 6 foot channel with rather small additional expense. Navigation facilities above the shoals to the head of navigation extending beyond Chattanooga are of negligible importance at low water although considerable money has been spent in developing them and work is now under way. This work has been in great measure open channel work which does not endure. Apparently permanent navigation can only be achieved by the creation of necessary locks, dams, etc., in accordance with a broad river policy.

Muscle Shoals is the most serious obstacle to navigation on the river. The completion of Dam No. 2 would fit into a permanent policy and would give 6-foot navigation over 15 miles of the shoals. The No. 3 dam would similarly fit into a permanent policy and would give 6-foot navigation over some 65 miles. These two dams plus the No. 1, which is necessary to connect the No. 2 dam with down stream navigation, could eliminate the Muscle Shoals obstacle.

The No. 2 dam can pay for itself on a power basis, and there can be little doubt therefore as to the logic of completing it.

The No. 3 Dam can not sustain itself as a power proposition at the present time unless some $6,000,000 are charged off to navigation. There is considerable doubt as to whether development of navigation at the present time is worth this expenditure.

It is to be remembered also that even though Dam No. 2 were completed, it would still be necessary to construct Dam No. 1 at cost of $1,400,000.

6. Hydroelectric power development: The Muscle Shoals hydroelectric power possibilities are the great natural asset of the region.

The Dam No. 2 is an excellent power proposition on the basis of additional cost and could sustain itself upon basis of total cost. The Dam No. 3 is not a good power proposition at the present time.

The question as to how to best dispose of this power to the maximum benefit of the maximum number is the most serious one connected with Muscle Shoals. Four schemes have been proposed:

First. Lease or sale of Muscle Shoals power project for 100 years with no control by Government over method of using such power or the rate at which it shall be used unless it should happen to come under State or Federal regulation of public utilities, with the exception, however, that an unknown and not stipulated quantity of power shall be used in the manufacture of fertilizers.

Second. Complete retention of control by Government through governmental construction and operation.

Third. Administration of Muscle Shoals power project in conformity with the national policy on water power development as outlined in the Federal water power bill. In this instance power project would be completed by private capital under license from Federal Power Commission and such license would guarantee governmental control of the project and allow Government to recapture at end of 50 years.

Fourth. Partnership between the Government and private capital by which each supplies a part of the capital and shares in profits or losses. Operation is by private capital methods under control by directors appointed by each

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party. In addition the general control system of the Government would apply.

In the natural course of development in the region that can be reached by Muscle Shoals power a market can be expected for the primary power for both dams and steam plant within a period of some three to six years. An additional three to six years would probably be necessary to develop a market for the secondary power of reasonable value. It is, of course, also possible to create new industries in the immediate vicinity of Muscle Shoals to utilize all the power therefrom. If this latter course is followed, many cities and towns to the south and west within transmission distance of Muscle Shoals will be deprived of possibility of obtaining hydroelectric power, as Muscle Shoals is practically the last large undeveloped source of supply available to the region.

It will probably take some two to three years to develop a definite load for the Muscle Shoals plants and it is therefore necessary that a definite policy on disposition of power be developed as soon as possible after determination is made as to what power is to be developed.

7. The question of reducing the price of fertilizers is one of vital interest not only to the farmers but to the entire country. The following summary is repeated from chapter on "Relation of Muscles Shoals to fertilizers":

"Some 55 per cent of the total cost of ingredients in fertilizers is chargeable to nitrogen, 30 per cent to phosphoric acid, and 15 per cent to potash. The cost of ingredients represents about 50 per cent of the cost of fertilizer to the farmer. To collect the ingredients, mix them, and distribute them, including sales expenses, profits, etc., represents about 50 per cent of the cost of fertilizer to the farmers. The transportation costs which are included in the above costs of ingredients, as well as in the collection and distribution costs, amount to some 30 to 40 per cent of the cost of fertilizer to the farmer. The carrier, namely, sulphuric acid, which is used to make ammonia available as fertilizer materials, represents a large item of cost. This sulphuric acid has no other fertilizer value.

"In the matter of ingredients, Muscle Shoals, on the basis of converting the No. 2 plant into a Haber electrolytic plant and with power at 2 mills, and allowing for all costs, including interest, depreciation, insurance, taxes, etc., but not allowing for profits, might save $32 per ton of nitrogen on the average selling price over the 1900–1914 period, and also the present price, namely, $281 per ton. This amounts to some 10¼ per cent of such price. If this saving were all given to the farmer it would amount to a yearly saving of $1,280,000, or about one-half of 1 per cent of the total fertilizer bill. And if such production forced a reduction of $32 a ton on all nitrogen consumed in fertilizer, the total saving to the farmer would be some $5,000,000 to $6,000,000, or some 2 or 3 per cent of present fertilizer bill.

"In the case of phosphoric acid present knowledge does not justify the statement that any savings can be made because no evidence is available that phosphoric acid can be produced sufficiently cheaply by electro-furnace methods to warrant its use in fertilizer in competition with acid phosphate produced by sulphuric acid.

"In the case of potash no savings can be made with present knowledge.

"In the matter of collecting, mixing, distributing, and selling mixed fertilizer which costs about 50 per cent of the total cost of fertilizers the greatest benefit can be obtained by 'home' mixing by the farmer himself. By this means he might be able to reduce his costs some 10 to 15 per cent. Muscle Shoals might have some beneficial effect in this respect, but it is difficult to measure it.

"Exclusive of rate consideration, transportation charges can be reduced in general by reducing the quantity hauled or by reducing the length of haul. The quantity hauled could best be reduced by increasing the strength of fertilizers and thus reducing the quantity of useless materials transported. This is in great measure dependent upon cheap phosphoric acid, which is a hope but not a reality. Length of haul could be reduced by manufacturing the ingredients and the fertilizers in the near vicinity of their use. If Muscle Shoals could equal the price of present commercial fertilizers or the ingredients thereof, it could affect favorably the price of fertilizers within a radius of about 200 to 250 miles of Muscle Shoals.

"In the matter of carrier, it costs some 20 per cent of the cost of nitrogen to convert ammonia into ammonium sulphate. This costs the farmer, exclusive of transportation charges, some $7,000,000 per year. With cheap phosphoric acid, some $5,000,000 of this cost could be saved. But while cheap power is

necessary to cheap phosphoric acid, there is no assurance at present that Muscle Shoals can satisfactorily solve this problem.

"To sum up, on basis of present knowledge, Muscle Shoals does not offer any reasonable expectation of even appreciably reducing the average price of fertilizers to the general farmer of the country. It does offer some hope of reducing the price of nitrogenous fertilizers only to the farmers living within a radius of some 200 miles of Muscle Shoals. It can make available to the fertilizer trade at a price equal to present price and pre-war average some 25 per cent of the present tonnage of nitrogen used in commercial fertilizers. With the extensive and intensive research and development that might go with the establishment at Muscle Shoals of a large and new fertilizer business, important and beneficial improvements in the methods of manufacture, distribution and use of fertilizers might ensue."

If the above summary is reasonably correct, the very difficult question is raised as to whether the best plan for the Government to pursue in an effort to cheapen fertilizer costs is to subsidize in effect some commercial company by selling to that company real property at less than its market value and by leasing to that company at a very low rate of interest for a period of 100 years power developed by Government money, and especially when practically all of such power will cease to be under governmental control.

VIII. Recommendations:

It is my personal belief that the following is the best solution to the Muscle Shoals problem:

1. Congress should establish the policy to be pursued and should require the Executive branch of the Government to carry out such policy. By so doing Congress will avoid the great difficulties incident to the negotiation of any contract.

2. The following policy is recommended:

(*a*) Dispose of Gorgas power plant and Warrior-Sheffield transmission line in accordance with existing contract with Alabama Power Co.

(*b*) Sell nitrate plant No. 1 to some responsible purchaser who will operate it in fixing nitrogen or in manufacturing fertilizer. If this does not seem feasible, sell on basis giving maximum return to Government.

(*c*) Retain, under control of Government as long as this is necessary for national preparedness, nitrate plant No. 2 including Waco quarry but excluding the steam-power plant. Lease or sell the nitrate plant to such lessee or purchaser as will properly guarantee to operate it in fixing nitrogen or in manufacturing fertilizer without impairing its necessary value for national preparedness, and with proper provisions as to limitation of profits developed as a result of governmental help.

Lease or sell the steam plant pertaining to nitrate plant No. 2 on most advantageous terms obtainable, but with suitable guaranties as to the availability of its power equivalent at fair price for either governmental or private operation of the nitrate plant or its equivalent over a reasonable period of time.

(*d*) Dispose of Dam No. 2, or Wilson Dam, in accordance with the Federal water power act on best terms obtainable in consideration for work already done.

If conditions seem to warrant it, take all or part of payments in terms of power and make this available at reasonable cost to such lessees or purchasers of the nitrate plant as agree to fix nitrogen or manufacture fertilizers, provided, however, that profits developed as a result of governmental help are properly limited.

(*e*) Appropriate sufficient funds to continue work on Dam No. 2 pending its disposition as outlined above.

(*f*) Handle Dam No. 3 in accordance with Federal water power act. Grant Government aid only to extent of the value of project to navigation.

3. The above policy could be carried out if section 124 of the national defense act, approved June 3, 1916, were repealed and if proper enabling act were passed.

The CHAIRMAN. In your recommendations you recommend that we sell nitrate plant No. 1.

Major BURNS. That is correct; yes, sir. It may seem as if I am a little inconsistent as a result of those questions you asked a little while ago, but I honestly do not believe that the Government should, directly or by subsidy of any great amount, go into the fertilizer business.

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The CHAIRMAN. Now, just assume that to be right for the purpose of the questions I am asking. It seems to me that you lose sight of the fact that the Government is justified—and I think you will agree with me in that—in manufacturing explosives and in keeping itself in time of peace so it can manufacture explosives in time of war?

Major BURNS. Yes, sir. That is correct.

The CHAIRMAN. That puts the Government in this business to some extent. Whether it wants to stay out of private business or not, it is a governmental function to take care of war?

Major BURNS. Yes, sir.

The CHAIRMAN. It so happens in making explosives or having machinery to do it, incidentally, and with comparatively little change they can make fertilizer. So is it not a little bit different, the Government being justified to mix into this business because of a war proposition, that it can also at the same time utilize its machinery and its products for the purpose of using the machinery in time of peace, but always keeping it ready for a war emergency?

Major BURNS. Here is the way that appeals to me: I think the Government must assure itself of proper protection of the country in time of need, but I think it ought to put maximum dependence on commercial development. If it can accomplish its purpose through commercial development, then I think that is the proper solution. If it can not accomplish its purpose through commercial development, then I think the Government itself should go into the business.

The CHAIRMAN. Would you follow that through to such an extent as to say that the Government ought not to build its own battleships—that they ought to be built by somebody else?

Major BURNS. Of course, it does build a great many of them.

The CHAIRMAN. I know it does; but do you think the Government is not justified in building battleships? We can get those built by private parties always.

Major BURNS. Of course, I doubt very much if you would get as efficient battleships in the long run if you built all the battleships by commercial companies.

The CHAIRMAN. I doubt it, too.

Major BURNS. It is therefore practically necessary to have them both work on them.

The CHAIRMAN. Some people believe the Government ought to build all the battleships, and I belong to that class for several reasons, and one of the reasons is that whenever you commercialize a weapon of war you give a great inducement to people to go into the business as a financial consideration and you get people urging on war that otherwise would be opposed to it.

Major BURNS. Yes, sir. There is no doubt about that.

The CHAIRMAN. Another thing in your recommendation, Major, that seems to me does not bear out your own testimony fully is the disposition of plant No. 1, which would mean that the Government would cease its investigations about the development of machinery to get nitrate from the air. Don't you think the Government is justified in maintaining laboratories and experimenting, confining it entirely to war considerations now, as a matter of national defense, to cheapen the method of getting nitrogen out of the air?

Major BURNS. Well, I think they are fully justified in carrying on that business so long as it is necessary for nitrogen preparedness, but I personally believe that we have got a reasonably satisfactory solution of the nitrogen preparedness problem right to-day.

The CHAIRMAN. In a way we have. But I know you will agree with this proposition, that the expense of it is very great, and the possibilities of investigation are very inviting to reduce it; and ought the Government not try to reduce it so as to save the expense of war if it should come?

Major BURNS. There is no doubt but that the Government ought to wage war not only so that it will win but also as economically as possible. We can not escape those principles. But if the Government goes into a commercial field it prevents commercial development, and to that extent it may harm the country rather than help it.

The CHAIRMAN. I admit that to some extent, but at the same time, if it was necessary or desirable as a war proposition to manufacture any article, then it is likewise desirable to manufacture it as cheaply as possible, and if it is necessary to make experiments in order to do it, even though it is expensive, they are justified in the expense, and is not that particularly true when it happens that the same product that they are going to try to cheapen for war

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purposes is one of the principal ingredients in fertilizer that all the people admit it would be extremely desirable to cheapen? I think the Government would be justified in operating plant No. 2 outside of the war proposition just for the purpose of experimenting on a practical commercial scale to see whether it could not cheapen fertilizer, and if it develops a method let it be free and open to anybody to follow it. It seems to me, either as a war proposition or as a peace proposition, it ought to somewhere—if not there, at some place—carry on very extensive investigations to see if it can not get a cheaper method of getting nitrogen out of the air, both because it has to do with national defense and because it is a very great necessity for all the people of the country, not the farmer alone but everybody who eats, to cheapen the cost of fertilizer.

Major BURNS. Of course, I think myself that governmental research is of extreme importance, and I think the Government can very well afford to spend large sums of money every year in governmental research.

The CHAIRMAN. Is not plant No. 1 one of the most desirable places, since we have the steam plant there, we have all the buildings there, houses for the fellows to live in, and everything? Is not there the greatest opening for the Government to make that kind of research?

Major BURNS. You could certainly do research work there very easily.

The CHAIRMAN. Take this ammonia. You are a chemist.

Major BURNS. I am a sort of a half chemist.

The CHAIRMAN. You have been in the employ of the Government ever since you completed your military education?

Major BURNS. Yes, sir.

The CHAIRMAN. And you have been devoting yourself to research in this line to a great extent, haven't you?

Major BURNS. Of course, I have been associated with research problems that have come up, but I myself have not worked very much on them.

The CHAIRMAN. You are very familiar with all the methods and all the different systems?

Major BURNS. In a general way.

The CHAIRMAN. Do you think the Government is justified in paying you to devote yourself to that kind of business? Has not that helped to bring about your own energies and your own efforts?

Major BURNS. I don't argue against your principle of governmental research, because I thoroughly agree in it.

The CHAIRMAN. Regardless of how we may disagree on everything else, it seems to me there is a great opportunity for the Government to carry on research work at No. 1. We have got to do this research work on a large scale, because you know what shows up well in a laboratory does not work out, lots of times, in quantity production. There we have the machinery and everything and it is admitted that the Haber process is the one that is inviting. The whole world admits that the improvement will come in that process.

Major BURNS. Consider the case of the Haber process. We ourselves worked hard for the purpose of perfecting the Haber process, and we had a large number of designs drawn up, and we had a large number of schemes in mind, but while we were doing it the plant at Syracuse was constructed and put in operation and proved to be successful. To have carried out our ideas would have cost in excess of $1,000,000 and we finally decided that we were not justified in recommending the expenditure of that amount, especially as we could not have continued the operation of the plant for more than a few months.

The CHAIRMAN. The Syracuse plant is not successful on a large scale, as I understand it. It would not be able to make fertilizers.

Major BURNS. As these figures seem to indicate, you can not make ammonia for use in fertilizers by the Haber-Bosch system, which is what they have up there, but with the Haber electrolytic it looks as if there is a chance.

The CHAIRMAN. Yes, and the hope is that the Haber electrolytic, if you started on that inviting field, you will discover something new and cheapen the process.

Major BURNS. Yes.

The CHAIRMAN. Why should we throw away all this property and sell it? It will have to go as scrap, nearly. Why should we throw it away when both as a peace proposition and as a war proposition we have right before us there an opportunity to go into this kind of work on a large scale, and it is conceded that improvements are necessary? As I get it from your testimony and from other scientific men who have testified, however disagreeable the fact is, I can

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not throw it away, and it is disagreeable, and I would much rather the result were different, because I would like to do something for the people on the fertilizer line; but now it is your judgment and it is the judgment of other scientific men who have appeared before us, all of them except those that have some definite interest in the result of our deliberations. It has been the consensus of judgment of all of those scientific men that unless we do have some improvement the possibilities of cheapening fertilizer are very small.

Major BURNS. That is correct. Senator, in writing up this summary, I studied over the fertilizer question a long time. As to how to handle the fertilizer end of it was a thing that I could not convince myself on. I feel something has got to be done to help solve the fertilizer problem, and I have come to the conclusion that you will get further if you give the necessary incentive to private capital to do something, and I have tried to include a definite incentive along this line in my recommendations.

The CHAIRMAN. Private capital has the incentive. He can get his patent.

Major BURNS. In my scheme the Government would turn over to private capital the power taken from Dam No. 2 at such prices as the Government should name in order to spur these people along, and it would be a very great help in the Haber electrolytic process, for instance, if you could sell them power at about a mill, as our figures indicate that they would have a big margin with such power. In addition, the nitrate plants could be disposed of at a price that would furnish an additional incentive to assist in the problems of fertilizers and nitrogen fixation. In other words, they are the possible incentive which is included in my recommendations.

The CHAIRMAN. That may be; but I have a great deal of doubt about the Government going to all the expense and letting somebody else have the possibility of getting the thing patented or otherwise getting a monopoly of it. If the Government is going to furnish the money and the power, it has got as good scientific men as anybody else. Why not let the Government go on with the experiments—they are going to cost a good deal of money, and I doubt whether private parties would do it—and if they discover something, open it up to the world and let everybody have it.

Let me ask you, Major—you come in contact with scientific men, and I am speaking now of chemists and engineers and geological men, of scientific men in the Government as distinguished from what I might call political men, like Senators, Congressmen, Cabinet officers, and the President. You have come in contact with them. Have you found that they are just as able and just as competent and just as earnest as fellows that are working for the Standard Oil Co. and other people, and don't you think they are a remarkably fine set of men?

Major BURNS. Yes, sir. I think they are second to none, so far as those qualities are concerned.

The CHAIRMAN. Could we not trust those men to experiment for us?

Major BURNS. Here is one point, Senator, with reference to Government operation that is of a great deal of importance, and that is that the incentive does not exist so much in Government operation as it does in private-capital operation.

The CHAIRMAN. Is that true of a chemist?

Major BURNS. Yes, sir. It is true all along the line.

The CHAIRMAN. Take the research laboratories, for instance.

Major BURNS. We have, as you know, been working on nitrogen fixation problems for a great many years.

The CHAIRMAN. Would you close that up?

Major BURNS. No, sir; I would not close it up, but it is an expensive thing to carry on, and you won't get as much out of it per dollar expended as I think private capital would.

The CHAIRMAN. Why does not private capital do it? There is no reason why private capital should not go into it. There is nobody wants to prevent them.

Major BURNS. They are in it. They are in those problems. They are working on them.

The CHAIRMAN. I know they are in many ways.

Major BURNS. Take the American Cyanamid Co., for instance, in its efforts to find products developed by the cyanamid process that could live under market conditions. They have had research work going on for years. They have carried on investigations with phosphoric acid for years, as Mr. Swann has.

Another great trouble with governmental operation is that there is no way in which the ideas can be developed outside of the laboratory in order to determine whether such ideas have commercial value.

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The CHAIRMAN. There is just where you get into my proposition. That is the reason why I want to hold nitrate plant No. 1, so you can do that very thing—operate it on a large scale as distinguished from a laboratory test, to see whether it will work out in actual practice.

Major BURNS. Of course, your argument there is very sound. I do not believe a laboratory experiment is of much use unless it is carried on and tried out in some plant on a commercial scale.

The CHAIRMAN. That is the reason I want to keep nitrate plant No. 1. The production there would not be a drop in the bucket, but if we cheapen the product we would not patent it but would invite everybody to use it, not only in this country but all over the world.

Major BURNS. I believe your argument with reference to research is sound. If you are going to do research work, you have to do it not only in a laboratory but combined with a plant that is operated on a sufficiently large capacity to get into commercial practice.

The CHAIRMAN. I have no doubt of that, because so often we find in consultation with our experts, and especially during the war I was in consultation with a great many of them, that the trouble was that they would get something that would look all right on a laboratory scale, but when it was tried out to see whether it would work on a big scale or not they would have to turn it over to some private party to see whether it would work or not, and this is what happened sometimes. They would have laboratory tests, and take some big corporation that was in that line of business, and if they found that they could suppress it and make more money by continuing on, especially if they had a monopoly of something, they would suppress it. It would be a matter of dollars and cents with them. They oftentimes try to kill things unless they can get a patent on it. If they can get a patent and shut other competitors out, all right. If the Government does that and makes the development, everybody gets it.

Major BURNS. There is one thing with reference to the Haber electrolytic process, Senator, that I would like to point out, and that is that you could probably take care of it as well at plant No. 2 as you could it plant No. 1.

The CHAIRMAN. The only objection I would have to that, Major, would be—you may be entirely right about it—that I have feared if we undertook to do that at plant No. 2, and there was some new process, some new modification by which you would have to take out machinery and put in new, you might have to dismantle part of No. 2 and have the thing rebuilt, and if war suddenly broke out you would not be able to use even No. 2.

Major BURNS. I had in mind that you could do that without in any way interfering with plant No. 2.

The CHAIRMAN. Of course if you could, that would be all right. I realize No. 2 plant down there is an expensive way of getting nitrogen out of the air.

Major BURNS. Yes; it is.

The CHAIRMAN. Unless it is improved in some way the farmer can expect no benefit out of it in time of peace, I am afraid.

Major BURNS. I don't think he can.

The CHAIRMAN. But I would be just as careful to preserve that just as it stands now as I would keep a battleship. If war broke out to-morrow that would be one of our mainstays, especially if it was with a power that had a good navy. So I would not want to dismantle it or do anything with it until we had first demonstrated that whatever change we contemplate is right.

Major BURNS. There is a lot of merit to your argument. There is no doubt about that.

The CHAIRMAN. For the purpose of getting into the record the geography of the situation I want to ask you a few questions. The committee all understand it, but anyone reading the testimony may not understand it, and it might help them in considering it.

Now, at the foot of Muscle Shoals are located two towns, one on the north side and one on the south side of the river?

Major BURNS. Yes, sir; Florence on the north side and Sheffield on the south side.

The CHAIRMAN. Those towns are connected by bridge?

Major BURNS. Yes, sir.

The CHAIRMAN. From those towns how far is it up the river to Dam No. 2?

Major BURNS. About three miles from the bridge up to Dam No. 2.

The CHAIRMAN. How far from Dam No. 2 to Dam No. 3?

Major BURNS. It is approximately 15 miles from Dam No. 2 to Dam No. 3.

The CHAIRMAN. What direction from Sheffield is nitrate plant No. 1.

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Major BURNS. It is about a mile south and west of Sheffield.

The CHAIRMAN. Nearly south, is it not?

Major BURNS. Yes, sir.

The CHAIRMAN. Where is nitrate plant No. 2, then, with reference to Sheffield and nitrate plant No. 1?

Major BURNS. Nitrate plant No. 2 is about 4 miles northeast of Sheffield and about 5 miles northeast of plant No. 1.

The CHAIRMAN. In other words, it is up the river from Sheffield?

Major BURNS. Yes, sir.

The CHAIRMAN. Where is the Waco Quarry?

Major BURNS. The Waco Quarry is near Russellville, Ala., about 26 miles south of Sheffield.

The CHAIRMAN. The Dam No. 2 will back up the river and make it navigable up to the location of Dam No. 3?

Major BURNS. Yes, sir.

The CHAIRMAN. And Dam No. 3 will make the river navigable about 65 miles farther?

Major BURNS. Yes, sir.

The CHAIRMAN. In order to make navigation available it would be necessary to build what is known as Dam No. 1?

Major BURNS. Yes, sir.

The CHAIRMAN. That has no power connected with it?

Major BURNS. No, sir.

The CHAIRMAN. It is entirely a navigation proposition?

Major BURNS. Yes, sir; just a small dam connecting the island——

The CHAIRMAN. Connecting the island in the river with the north bank of the Tennessee River, and is right near the bridge that connects Sheffield and Florence?

Major BURNS. Yes, sir.

The CHAIRMAN. You have given the railroad mileage, Major, at the different locations. How much standard-gauge railroad have we at Waco quarry and nitrate plant No. 1 and nitrate plant No. 2?

Major BURNS. There are 49.6 miles of standard-gauge track at plants 1, 2, Waco quarry, and Gorgas.

The CHAIRMAN. Now eliminate Gorgas from that. How much have we? Or you can do it by saying how many miles we have at Gorgas.

Major BURNS. Of this amount 1 mile only is at Gorgas.

The CHAIRMAN. Then it is between 48 and 49 miles of railway, standard gauge, that we own outside of what we own at Gorgas and outside of what we own at the dam?

Major BURNS. Yes, sir.

The CHAIRMAN. How much do we own at the dam?

Major BURNS. I have not got that figure. I will have to get that for you and put it in the record. I will put it in the record when I revise my testimony.

The CHAIRMAN. How many locomotive engines altogether does the Government own in connection with Muscle Shoals?

Major BURNS. There are 13 railroad engines belonging to the two nitrate plants, including Waco quarry, of which 6 are now on loan to the Corps of Engineers at the Wilson Dam.

The CHAIRMAN. The Wilson Dam as such does not own any?

Major BURNS. I don't know whether they own any or not, Senator, but we have loaned them six. But I will look that up.

The CHAIRMAN. It is important to know, if we accept the Ford offer, whether we would get—well, it is not of much importance, because they would wear out in a hundred years. How many?

Major BURNS. That question I can not answer. I will give you that later.

The CHAIRMAN. How many railroad cars, including the whole thing, everywhere?

Major BURNS. We have everything here for nitrate plant No. 2, because that is the way the question was asked in your letter.

The CHAIRMAN. They all go. It does not make much difference whether they are leased or sold.

Major, of what use is the Gorgas plant over on the Warrior River to the Government of the United States now? What use is it to us? Is it a necessity?

Major BURNS. No, sir. O course nitrate plant No. 2 would require 100,000 horsepower if we had to operate it, and of that amount we have only got 80,000 at nitrate plant No. 2.

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The CHAIRMAN. If war should break out before Dam No. 2 is completed and we had to depend on the power to operate nitrate plant No. 2, the steam power we have there would not be enough to operate it?

Major BURNS. No, sir.

The CHAIRMAN. We would have to get a little more power?

Major BURNS. Yes, sir.

The CHAIRMAN. We could commandeer that from the company?

Major BURNS. Yes, sir. But I don't think there is any reasonable justification for hanging onto the Gorgas power plant any longer.

The CHAIRMAN. Is this true, that the only object that the Government had in mixing up in that connection at all was in order to get temporary power to use in the construction of these two great plants and the dam?

Major BURNS. And to operate during the probable period of the war.

The CHAIRMAN. You would not need it if the dam was completed, even during war?

Major BURNS. Of course the dam, in a way, is not definitely tied into the No. 2 nitrate plant.

The CHAIRMAN. I understand that, but if the Government owned Dam No. 2 and nitrate plant No. 2 it would not have any use to go to Gorgas and get power, would it?

Major BURNS. None whatever; no, sir.

The CHAIRMAN. So that the practicability of having Gorgas, which is over in another river valley, tied up, is of no permanent value to the United States if it has power of its own?

Major BURNS. Not that I can see; no, sir.

Mr. LEVERING. Senator, could I make a suggestion?

The CHAIRMAN. Yes.

Mr. LEVERING. That the branch running from plant No. 2 to the quarry should be kept by the Government, because they ought to have that if they ever have to operate the quarry in a hurry. That 26 miles of transmission ought to belong to the Government because it is of no use to the Alabama Power Co., and it is of very great use to the Government.

Major BURNS. Your point is very well taken from the standpoint of assuring a supply of power for Waco quarry.

The CHAIRMAN. Let us get that in the record. Waco is on this line—

Major BURNS. Yes, sir.

The CHAIRMAN. Which runs over from Gorgas?

Major BURNS. Passes by Waco.

The CHAIRMAN. Passes by Waco, and you operate that quarry from that current?

Major BURNS. Yes, sir. That is correct.

The CHAIRMAN. If the Government sold the transmission line and wanted to operate Waco, it ought to retain, then, the transmission line from Waco to Sheffield, which would be about 26 miles of it?

Major BURNS. It ought to assure itself of a supply of power. But of course there would be a question as to whether you would be justified retaining the transmission line for the small amount of power used at Waco. As I recall the figures, you use about 750 horsepower at Waco, and it is a question of economy as to whether you would be justified in holding the transmission line for such a small amount of power.

The CHAIRMAN. How would you operate Waco?

Major BURNS. You might be able to establish a steam plant to produce 750 horsepower in time of need.

The CHAIRMAN. If you are going to operate plant No. 2 even to make fertilizer, you would need Waco?

Major BURNS. By the cyanamid process there is no doubt but what you would need power to operate the quarry. There is doubt as to what is the most economical way of getting that power. It is a question of whether you would be justified in keeping the transmission line for that purpose or whether some other solution might not be the more economical.

Mr. LEVERING. You have already got it.

The CHAIRMAN. Even if that was disposed it, the Government could construct another one from Waco over.

Major BURNS. Yes, sir; or if it were sold you might be able to sell under the guaranty that that power would be available at the Waco quarry.

The CHAIRMAN. Not the power but the use of the transmission line.

Major BURNS. Yes, sir; the use of the transmission line.

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The CHAIRMAN. I think that is an important thing. It does not amount to very much money, but we ought to consider it.

Major BURNS. You ought to assure yourself of a supply of power at Waco.

Mr. LEVERING. Can I make another suggestion, Senator?

The CHAIRMAN. Yes.

Mr. LEVERING. That is to say, if you sold plant No. 1 you might just as well burn up plant No. 2, because it is absolutely useless to the Government if you sold plant No. 1, because you could not make any improvement at all if you cut out No. 1. You have to have that to make your improvement on and keep the other one in standby condition. You might just as well burn up No. 2 if you sold No. 1.

(Whereupon at 1.45 o'clock p. m. the committee adjourned to 10 o'clock a. m., Friday, June 23, 1922.)

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MUSCLE SHOALS.

FRIDAY, JUNE 23, 1922.

UNITED STATES SENATE,
COMMITTEE ON AGRICULTURE AND FORESTRY,
Washington, D. C.

The committee met, pursuant to adjournment, at 10.30 o'clock a. m., in room 224, Senate Office Building, Senator George W. Norris (chairman) presiding.

Present: Senators Norris (chairman), Capper, Keyes, Ladd, and McKinley.

The CHAIRMAN. The committee will come to order.

Mr. Wells is here this morning at my request. I have known Mr. Wells for a great many years. He was formerly in the service of the Government, when Mr. Pinchot was Forester, and he is a recognized authority on conservation problems. When I found he was in the city I invited him to come before us on this proposition. I do not know how much consideration he has given to any of the questions involved here, but I do happen to know that years ago, when the Muscle Shoals proposition was up in the House, he had a great deal of information in regard to it.

Now, Mr. Wells, proceed in your own way.

STATEMENT OF MR. PHILIP T. WELLS, ATTORNEY AT LAW, MIDDLETOWN, CONN.

The CHAIRMAN. First, for the record, tell just who you are.

Mr. WELLS. I am a lawyer. I reside in Middletown, Conn. I have been interested in conservation matters and in water power particularly for 15 years. I am now president of the Connecticut Forestry Association.

The CHAIRMAN. Have you any personal or financial interest in any way, excepting as a citizen, in Muscle Shoals?

Mr. WELLS. None whatever, Senator. I was, from 1907 to 1910, chief law officer of the Forest Service, and in that capacity had also administrative charge, under Mr. Pinchot, of water-power matters in the Forest Service.

During those years we developed a system of leasing water-power sites in the national forests. I had charge of that work, and carried on negotiations with the applicants for leasing, and with those who contended we had no legal authority to lease. Then when Mr. Pinchot left the public service I was counsel for the National Conservation Association, and continued to interest myself, from the public point of view, in the water-power legislation then pending.

I will also say that in the years 1907 to 1910 I was counsel to the power committee of President Roosevelt's Inland Waterways Commission, and in that capacity it was my business to scrutinize and advise upon all legislation for the development of water power in navigable rivers, and I negotiated with water-power men advocating legislation of that kind.

From 1911 to 1913 I was chief law officer of the United States Reclamation Service in the Interior Department. I was in the office of the secretary, Mr. Walter L. Fisher, of Chicago, and was his special adviser upon conservation matters in general, and upon water power in particular; and in that office I took part in framing the water-power-leasing policy on the public lands, and also I negotiated with applicants for water-power privileges. Particularly I remember negotiating the lease to the Great Falls Power Co. of Montana for the electrification of the Pacific extension of the St. Paul Railroad.

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I again left the Government service in 1913 and was in the practice of law in Washington here for four years thereafter. During that time I continued to interest myself in conservation legislation, and particularly water-power legislation, and was in frequent conference with Senators and Representatives who were advocating legislation satisfactory to the conservation point of view, which ultimately resulted in the water power act of 1920. I also appeared before committees of the House and Senate on water-power bills.

During all those years there was a very hard and persistent fight on the part of ourselves to establish certain principles of water-power policy. We thought that wherever the Government had the say so as to water-power development it should insist upon the application of these principles. We developed these principles first in the national forests and then extended them to the navigable rivers. We were bitterly fought by all the water-power people at first, and later some of the water-power people conceded the justice of our claims and were for a time willing to come in under them. It was my duty, as I say, to negotiate water-power permits or leases, to scrutinize and help formulate legislation, and to negotiate with water-power men who advocated legislation of one kind and another.

In the course of this duty I drafted the two vetoes which President Roosevelt sent in on water-power bills in 1908 and 1909, basing his reason for vetoing them on the fact that they did not conform to these principles.

That struggle went on not only in Congress but before the public. There were various bodies organized on one side or the other to debate this subject and influence public opinion. Among others was the national conservation congress, the public lands convention held in Denver, and I think other conventions held at various points around the country. The matter was thoroughly debated there. As I say, we found ourselves opposed at first by all the water-power people, later by a majority of them, and that majority controlled the general attitude of the water-power industry. Among the most persistent opponents was the Alabama Power Co. at that time. I well remember that we were denounced as usurpers of State authority by many members of the Alabama delegation in Congress, and the impression I retain is that Alabama had turned over practically all her water-power resources, so far as she could, to that corporation, and the Alabama Representatives here as a whole, as I remember it, were opposed to us in trying to put any control upon water power by Federal authority. That was notably so with respect to a veto of a bill to license a dam on the Coosa River, which veto was sent in by President Taft in the latter half of his administration, acting, I believe, upon the advice of Secretary Stimson, of the War Department, and Secretary Fisher, of the Interior Department. That veto was very vigorously denounced by the Alabama Representatives in both Houses on the floor of Congress and also at the national conservation congress held in this city, I think in the fall of 1913.

The first sign of the yielding of the water-power people, so far as I recall, to our contention was in the case of the Connecticut dam bill in the latter half of the Taft administration. At that time there was a proposal to develop the water power above Hartford at what is called Enfield Rapids, where there is, I am told, about 30,000 horsepower to be developed. The proponents of that scheme came to an understanding with Secretary Stimson, of the War Department, that they would accept the principles of what we call the Roosevelt water policy, and a bill especially designed for that development was introduced in Congress and debated in the Senate. It was defeated by a combination of the southern and far-western Senators who opposed these principles.

Now, I will add that I am confident, although I have not examined the record since, that the Alabama Senators and Representatives who denounced the Coosa Dam bill veto were among those who voted against the Connecticut dam bill. I don't remember all the personalities connected with those negotiations, but I have a recollection which, if it is wrong, I would like to have corrected, that Mr. Worthington was one of those who in all this controversy opposed us, and I think acted for the Alabama Power Co., though I would like to be corrected if I am wrong about that. I notice that he is apparently now acting for Mr. Ford; and if so, I think he is entirely consistent with what he did before and is upholding the views which he then held about public policy.

The CHAIRMAN. When you refer to Mr. Worthington you mean the gentleman who has appeared before this committee?

Mr. WELLS. Yes, sir; I think he is the same man. If I am wrong about that I want to be corrected. But it seems to me significant, and bears out my contention, that this proposition is like the other proposition, and he is consistent in his attitude.

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There were certain principles of that policy for which we contended all those years. The first one was that there should be no grant of water-power privileges for more than 50 years. The second was that there should be some rental paid to the Government for the raw water power. The third was that there should be public control of the rates charged to consumers and the service rendered to them by the lessee. Then it was always assumed that the lessee was going to risk his own money in building the works and take the risk of any disaster that might come to them. There was the further principle which we contended for, and which was finally embodied in the water power act, that excess profits, if any existed after regulation of rates and service, should be paid to the Government.

Now, the Ford proposal seems to me to violate every one of those principles. There is not pretense of any rental for the raw water power. There is no 50-year limit. There is no proposal that either the Federal Government or the Alabama Power Commission, if there is such a thing, can control the rates that Mr. Ford will charge or the services that he will render to consumers. There is no provision that if he makes excessive profits those profits shall go to the Federal Treasury.

In all those things it is just exactly like what the Alabama Power Co. used to demand in the old days. But it goes further than that. It asks a vast contribution from the Federal Treasury to the cost of Mr. Ford's plan. Now, that idea is not entirely novel. The first time such a proposal was made, to my knowledge, was in behalf of some Alabama people before the power committee of Roosevelt's Inland Waterways Commission at a session which I was attending as counsel of that committee, but the proposal then was a modest one compared with this, so far as Government expenditure was concerned, and it never got anywhere.

Then this proposal asks the Government to give Mr. Ford free insurance for a hundred years against flood and earthquake.

The CHAIRMAN. That is not quite true. He pays $35 000 per year on one dam and $20.000 per year on the other.

Mr. WELLS. As I compute it, Senator, since his pretended interest payments are not a real 4 per cent on the Government investment, I have charged back——

The CHAIRMAN. That might more than counterbalance it. Of course, he does not pay quite 4 per cent.

Mr. WELLS. Exactly; but the public is led to believe that he does.

The CHAIRMAN. I know they are; but the offer particularly states that he shall pay to the Government $35,000 a year for maintenance of Dam No. 2 and $20,000 a year for maintenance of Dam No. 3, and the Government, in consideration of that payment, guarantees to repair and keep in repair and maintain the dam, outside of the machinery end of it.

Mr. WELLS. Yes. Senator, I have not overlooked that, but I am glad you called my attention to it.

This offer goes before the country as a proposal on the part of Mr. Ford to pay 4 per cent on the Government investment. When I read the contract, of course it is not so, but that is the way the country has got it, and therefore I put the $35,000 in as part of the interest in my calculation on the United States investment.

The CHAIRMAN. It does not make it then, does it?

Mr. WELLS. It does not make anything like 4 per cent then. Therefore I say the offer means free insurance. Moreover, though I am not an engineer, I have consulted with engineers, and water-power engineers in particular, in all these years, and the $35,000 per year is ridiculous not only as an insurance premium against disaster but it is ridiculous as a maintenance charge against ordinary wear and tear, if I am correctly informed. However, I can not say that with authority, because I am not an engineer.

I have already said, perhaps, what I had to say about the false notion that has got abroad that the United States is to be paid the full interest at 4 per cent on its investment. As a matter of fact, it is to be paid nothing of the sort. I have not computed it on Ford's final offer. On the first offer I computed it as about 3 per cent or perhaps 3½ per cent. I forget the precise fraction. That is counting in all his amortization and everything else as interest.

Now, I never yet have seen a proposition made to the Government that was as outrageous as this in water-power matters. As I say, for many years I dealt for the Government with water-power men demanding legislation, and I must say that all the Wall Street men, etc., as we call them, that I have

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dealt with are pikers in comparison to Mr. Ford in this matter. If this thing is accepted, it will be unfair to the water-power men who, after this fight, have accepted the water power act. It makes the water power act of no value. Taking human nature for what it is, it is practically certain that every one of them will demand as near to what Mr. Ford gets as their acquisitiveness and assurance will let them.

The CHAIRMAN. In case we should do a thing of that kind we would be inviting just such a result, would we not?

Mr. WELLS. Certainly.

The CHAIRMAN. It would mean the scrapping of our former policy and establishing of a new one on a new basis.

Mr. WELLS. It means absolute destruction of what we fought for for the people here for 15 years and won. That is why I am here.

In the Ford proposal there is the inducement held out of cheap fertilizer. I can not find in the offer any binding contract to make fertilizer at all events, much less to make them cheap. I have no doubt that Mr. Ford, if he gets this thing, will use a small fraction of the total power installation with which he will run one of the nitrate plants for making fertilizer, if he can do it at a profit, and that he will endeavor to cheapen the product; but I do not see anything in the contract that compels him to do it if he finds it is unprofitable, and, of course, it follows that he is not compelled to make them cheaply. He does promise to restrict his profits on that branch of the enterprise to 8 per cent, but there is no standard as to how that 8 per cent is to be calculated. If the Ford proposal were to be accepted, I think that ought to be written into the bill, and that the cost should be computed on some established basis of value of the plant, and not the value that Mr. Ford puts upon it when he wants to buy it, at less than junk value, and upon the value of the water power that he has to use.

As contrasted with the Ford offer, I have examined, Mr. Chairman, your bill, at your request. The Norris bill, which I refer to, is Senate bill 3420, and that bill proposes that the works shall be completed and operated at Government cost. There are two good reasons for that. One is that the whole matter began and still rests in military necessity. The proposition is a munitions proposition first of all, and all the proposed legislation recognizes that. Everything else is incidental.

In the second place, we have made a big investment of somewhere in the neighborhood of a hundred million dollars there; and we have a right to protect that investment, though ordinarily we might not want the government to go into the power business. The Norris bill gives preference in the disposal of the surplus power to cities, counties, and so forth. If there is any profit made out of it it goes to the Treasury of the United States, where it belongs.

The bill provides for storage so as to make the whole great installation at the power site available all the year round, so far as practicable. It also proposes to assure the manufacture of fertilizer or fertilizer products, and their sale as cheaply as practicable. All those things are certain under the Norris bill. The Norris bill is, therefore, entirely consistent with the water power policy for which we have fought all these years, and the only apparent inconsistency is that it is to be a Government-operated plant, and the abundant reason defending that exception is that the whole thing is a military necessity, and further, that we have an enormous investment there which we must protect.

I think the Norris bill could be improved in certain respects. I do not notice any provision in it for an appropriation, but the practice with respect to appropriations is quite radically changed since I was familiar with it, and it may not be necessary to have such a provision in the bill.

The CHAIRMAN. I think, if I might interrupt you there, Mr. Wells, it would be necessary to have a provision of that kind, or some other provision for its getting capital will be necessary in the bill. It might be provided, and I have had this in mind, by an authorization to the corporation that is set up, to dispose of the Gorgas plant, for instance, which ought to be disposed of, and such other property as may not be necessary—and there is a great deal of that in the management of the concern—there is a great deal of property there amounting, I think, to more than a million dollars—perhaps $2,000,000—that was used in the construction of all this property, not now needed, and it could just as well be sold, at least after the dam is finished.

Mr. WELLS. Then I think that some procedure for condemning the storage sites should be incorporated in the bill, rather than leave it in general terms; and the same for the assessing of storage benefits upon existing power plants whose capacity would be increased by the water stored at Government expense.

Then, as to the chemical corporation which is to be owned by the Government, and which is to be the means of operating this project, I personally would rather see a single head than three directors. I think you would get better results with a single director, with a salary limit of $15,000, rather than three at $7,500 each. I don't know whether it would be possible to appoint the director in any other way than by presidential appointment on advice and consent of the Senate, but whenever we see a provision for appointment by the President, by advice and consent of the Senate, we begin immediately to think of what we call politics, and politics ought to be kept absolutely out of this thing, and the bill clearly shows that such is its intent. There are very excellent provisions in the bill as to the other employees to prevent their being appointed or retained or promoted on political considerations, or for any other reason than their efficiency. I don't know whether that obstable could be gotten around or not, as to one director or the three directors, and it occurs to me that possibly a requirement of some certification of his qualifications to the President, by recognized scientific and business administration bodies, might get over the difficulty. I have not thought this out, but possibly if he were certified by the Carnegie Institution and the School of Business Administration of Harvard University, or any other university—they happen to have one there that I know of—that something of that sort would get over the difficulty, and then let the President appoint on that recommendation. You might in that way get better results than giving it the course of a political appointment.

I have some doubt about the removal by resolution of the House and Senate, for the reason that it might be considered an invasion of Executive power by the legislative. I have not worked that out either, but that occurs to me in reading the bill.

The CHAIRMAN. Now, Mr. Wells, on that point don't you think there ought to be some power lodged somewhere to remove these officials?

Mr. WELLS. Oh, there must be; unquestionably.

The CHAIRMAN. That state of affairs must exist some place.

Mr. WELLS. Absolutely. They ought to be removable.

The CHAIRMAN. Of course, we don't want them removable at the will of the President, for instance, because that would get it back into politics, or might. It is possible, of course, for a majority in the House and Senate to remove for political purposes, but to my mind it is hardly probable that the House and Senate could command those two bodies in that sense, using them for political purposes. There would be such a diversity of opinion and such strong knowledge of the thing on the part of the public, that no majority would dare take the condemnation of public sentiment that would follow the doing of a thing of that kind.

Mr. WELLS. I am glad to hear you say that, Senator, in view of certain things that have been noted in the public press lately in the way of demands for removal of officials. I don't know myself. My thought is directed wholly to the constitutionality of the device. I recall the controversy on that subject which we find in the history books, especially as I recall it during the Johnson administration, with respect to the attempt of Congress to prevent the removal or control of General Grant by the President. I have not examined the question with care, but the doubt is suggested.

Then to strengthen the nonpartisan and nonpolitical character of the corporation, it seems to me it would be well to bar the director and the employees from all open party activities. They ought not to take the stump or attend conventions or do anything of that sort, which is very useful work that somebody has got to do, but that won't mix with this business.

Now, as to the sale of fertilizers. I don't know whether it would be possible to restrict that to sale for cash only to farmers and cooperative organizations of farmers direct. If it were practicable to do that, I think it desirable.

I also think that there ought to be accounts set up for the business, giving a book value to the investments and the various parts of it, and, since we are proposing this as a substitute for Mr. Ford's offer, that we give a book value equivalent to Mr. Ford's offer. Mr. Ford's offer is $5,000,000 for the two nitrate plants and a lot more stuff that has cost the Government $85,000,000. So for this nitrate corporation I would propose that that should be entered on the books of the Federal Chemical Corporation as $5,000,000.

And so Ford's estimate of $40,000,000 for the completion of the power dams. In that he does not propose to compensate the Government at all for what it

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has already spent, something under $20,000,000 on that part of the enterprise. So I propose that the books of the Chemical Corporation should enter the value of the dams at the figure that Mr. Ford fixes, namely $40,000,000.

Then I think there should be a provision that the munitions delivered to the War Department should be credited to the Chemical Corporation at a fair price and also the service rendered by the corporation to navigation, whatever it is, big or little. All these things should be embodied in the bill, and the bill should require the corporation to endeavor, so far as practicable, to operate the plant at a profit on that investment.

Now, I see that the bill provides that the main office shall be at or near Muscle Shoals. I do not know whether that would be the best place. It is quite likely that it would. On the other hand, it might be that the main office—the director's office—should be near the market. I have no knowledge of the fertilizer market and do not know about that.

The CHAIRMAN. That is pretty well located, Muscle Shoals, to the fertilizer market.

Mr. WELLS. Well, I do not know about that.

That is about all I had in mind to say, Senator.

The CHAIRMAN. Have you any questions, Senator Keyes?

Senator KEYES. No, sir.

The CHAIRMAN. I will say, Mr. Wells, that while I have included Dam No. 3 in this bill I had just a little doubt about it myself when I put it in whether it ought to be in there. It is not necessary, of course, to have Dam No. 3 to perform all the functions I have set out in that bill. While personally I would have no objection to the Government building No. 3 in order to clean it up—and it seems to me somebody ought to clean it up—I realize that there is a great feeling in Congress that the Government would be amply protected without building Dam No. 3, and there is no reason why we should build it. Yesterday we had a witness before us, Major Burns, who has given us some very valuable computations on various kinds of estimates on the financial end of these two dams, and he figures out that Dam No. 3, if constructed, would hardly pay for itself. His figures show that No. 2 will make a large profit. It, of course, may be that when the matter is reported out of committee and it gets on the floor of the Senate, they may eliminate No. 3 entirely from the bill. I would not have any serious objection. It would leave the Government entirely protected. If we get the bill at all, we may find ourselves with Dam No. 3 eliminated.

We are very much obliged to you, Mr. Wells. I think we are very fortunate in being able to get you here.

Major Burns, I think I ought to say to you on behalf of the committee that we feel under great obligation to you, and we appreciate your constant attendance and assistance to the committee, and particularly as chairman I want to thank you for your very valuable services in gathering together information as I have called on you for it at various times during the hearings. So far as we can see, we believe that your services have been absolutely unbiased and, personally, I do not agree with your recommendation which has been made. That, I think, demonstrates that there has been no attempt on my part as representing the committee to get anybody to assist us who wanted to advance his own ideas at all, but only to get the facts, and in all your services you have carried out that plan in fine shape. On behalf of the committee I want to thank you very sincerely.

Senator KEYES. I am sure all the committee will agree with you, Mr. Chairman.

Major BURNS. I thank you, Senator, very much. It has been a real pleasure to serve with the committee.

(Whereupon at 11.20 o'clock a. m. the committee adjourned subject to call of the chairman.)

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